MACKENZIE MOUNTAIN
NON-RESIDENT AND NON-RESIDENT ALIEN
HUNTER HARVEST SUMMARY
2007

Northwest Territories Environment and Natural Resources

MACKENZIE MOUNTAIN
NON-RESIDENT AND NON-RESIDENT ALIEN
HUNTER HARVEST SUMMARY
2007

NICHOLAS C. LARTER AND DANNY G. ALLAIRE

DEPARTMENT OF ENVIRONMENT AND NATURAL RESOURCES
GOVERNMENT OF THE NORTHWEST TERRITORIES
P.O. BOX 240
FORT SIMPSON, NT
X0E 0N0

2008

Manuscript Report No. 180

The contents of this paper are the sole responsibility of the authors.

ABSTRACT

Each of the 8 licensed outfitters and the Renewable Resource Officers from the Sahtu and Dehcho Regions, Department of Environment and Natural Resources (ENR), collected data on big game harvest in the Mackenzie Mountains during the 2007 hunting season. Harvest data and observations of wildlife from non-resident and non-resident alien hunters (collectively called 'non-resident' for this report) were recorded. For 2007, 399 hunters bought non-resident licences. This is the second greatest number of licences sold to non-resident hunters since 1991 (range 321-407 from 1991-2006). Hunters (n=311) from outside Canada (non-resident aliens) were primarily from the USA (n=259) and comprised 65% of the outfitted hunters; 13 and 12 of the 52 European hunters were from Germany and Spain, respectively. There were 88 (22%) Canadian hunters whose residency was from outside the Northwest Territories (NT). Of the 399 non-resident licence holders, 351 came to the NT and most spent at least some time hunting. Of 266 tags purchased for Dall's sheep, 216 rams were harvested (including 6 by resident hunters). The average annual harvest of rams is 199 over the past 17 years. The mean (±SD) age of harvested rams was 10.8 ± 1.6 years; the 20th consecutive year the average age of harvested rams from the Mackenzie Mountains has been 9.5 years or older. This is the highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967). Hunters reported seeing an average of 11.0 legal rams (horns at least ¾ curl) per hunt and observed an estimated 63.9 lambs and 83.2 rams per 100 ewes, respectively. This is the highest lamb:ewe ratio recorded since 1995. Of 272 tags

purchased for mountain woodland caribou, 165 bull caribou were harvested. Hunters observed an estimated 52.3 caribou calves, and 36.6 bulls per 100 adult female caribou, respectively. Of the 108 tags purchased for moose, 74 bull moose were harvested equalling the greatest harvest in 2005 (range 32-74). Hunters observed an estimated 35.6 moose calves, and 100.7 bulls per 100 adult female moose, respectively. This is the highest calf:cow ratio since records began in 1995. Of the 50 tags purchased for mountain goat 21 goats were harvested, 17 billies, 3 nannies and 1 unknown sex. This is the highest harvest of mountain goats since we started records in 1991 and may be related to greater accessibility to the more rugged and remote parts of the various outfitter ranges where goats are resident. The mean age, determined by horn annuli, of 19 goats harvested was 7.8 years (range 2.5-13.5 years). Hunters observed an estimated 71.2 goat kids and 57.7 billies per 100 adult nannies. Of particular note is that, based upon information provided by the voluntary hunter observation forms, in 2007 the ratios of young of the year per 100 adult females for all 4 ungulates (Dall's sheep, mountain caribou, moose, and mountain goat) was either the highest recorded or above the average since records began in 1995. Twelve wolves were harvested from 227 tags purchased. During 1991-2006 mean annual wolf harvest was 13 (range 7-23). No wolverines were harvested from 150 tags purchased. The 13 wolverines observed by hunters in 2007 was similar to the lower numbers observed from 2000-2003; less than the 20-35 observations during 1995-1999 and 2004-2006. All observations of wolverine were of solitary individuals. No black bears were harvested from 7 tags purchased; none have been harvested in 12 years. There has been no grizzly bear hunting season for non-residents since 1982. Hunter

satisfaction remains high; 93% of respondents (n=239) rated their experience as either excellent (81%) or very good (12%). A number of hunters made specific comments about the high quality hunting experience and the abundance of wildlife in the Mackenzie Mountains; 27% were repeat clients returning for their 2nd to 17th hunt in the Mackenzie Mountains, and 89% indicated they would like to return in future years. Unfortunately the percentage of Voluntary Hunter Observation Forms returned by those who hunted was 65%, similar to that in 2006. At least 3748 kg of wild game meat, mostly moose and mountain caribou, was reported distributed locally in 2007. Replacement cost of meat from local northern retailers is estimated conservatively at about $74,960.

TABLE OF CONTENTS

ABSTRACT iii

LIST OF FIGURES ix

LIST OF TABLES xi

INTRODUCTION 1

METHODS 9

RESULTS AND DISCUSSION 10
- Hunters 10
- Dall's Sheep (*Ovis dalli dalli*) 16
- Mountain Caribou (*Rangifer tarandus caribou*) 25
- Alaska-Yukon Moose (*Alces alces gigas*) 30
- Mountain Goat (*Oreamnos americanus*) 34
- Wolf (*Canis lupus*) 37
- Wolverine (*Gulo gulo*) 38
- Black Bear (*Ursus americanus*) 41
- Grizzly Bear (*Ursus arctos*) 44

ACKNOWLEDGEMENTS 48

PERSONAL COMMUNICATIONS 49

LITERATURE CITED 50

APPENDIX A.
Outfitters Licenced To Provide Services To Non-resident Hunters In The Mackenzie Mountains, NT – 2007 55

APPENDIX B.
Summary Of Fees, Bag Limits, and Seasons For Big Game Species Available To Non-residents In The Mackenzie Mountains, NT - 2007. 56

APPENDIX C.
Comments Provided From Non-resident Hunters In The Mackenzie Mountains, NT On Voluntary Hunter Wildlife Observation Report Forms, 2007 57

APPENDIX D.
A Summary of the 2007 Voluntary Hunter Comments Broken Down Into Specific Topics. 61

APPENDIX E.
Number, Age, and Horn Length Measurements of Dall's Sheep Rams Harvested By Non-resident Hunters In the Mackenzie Mountains, 1967-2007. 62

APPENDIX F.
Summary Of Age and Sex Ratios Calculated From Non-resident Hunter Observation Reports in the Mackenzie Mountains, 1995-2007. 64

APPENDIX G.
Outfitted Non-resident Hunter Harvests In the Mackenzie Mountains, 1991-2007. .. 65

LIST OF FIGURES

Figure 1. Outfitting zones in the Mackenzie Mountains, Northwest Territories - 2007 ... 3

Figure 2. Example of a completed Mackenzie Mountain Outfitter Hunt Report Form 7

Figure 3. Example of a fully completed Hunter Observation Report Form 8

Figure 4. The number of Dall's sheep, moutain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2007. 20

Figure 5. The relationship between the horn length (cm) and age (based upon horn annuli) of 42 mountain goats harvested in the Mackenzie Mountains 2005-2007. Line of best fit is a 3rd order polynomial. 36

Figure 6. The number of wolverines observed by hunters from 1995-2007 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms..... 41

Figure 7. The percent of 'cubs' and the total number of adult grizzly bears observed by hunters from 1996-2007. Data are based upon voluntary hunter observation forms. The linear trend of total adult bears observed during the same time period is indicated..... 45

LIST OF TABLES

Table 1. Province, state and/or country of origin for the 399 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2007 12

Table 2. Percentage of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2007 12

Table 3. Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2007 15

Table 4. Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2007 19

Table 5. Mean length (± SD) and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2007 20

Table 6. Horn measurements of Dall's sheep rams harvested in the Mackenzie Mountains, 2007 21

Table 7. Age-structure of Dall's sheep rams harvested by non-resident and resident (n=6) hunters in the Mackenzie Mountains, 1995-2007 22

Table 8. Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2007 23

Table 9. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995 - 2007 24

Table 10. Mean length (± SD) and range (in days) of mountain caribou hunts where at least one day was spent hunting from 2000-2007 25

Table 11. Observations of mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2007 26

Table 12. Antler measurements of mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2007 27

Table 13. Mean length (± SD) and range (in days) of moose hunts where at least one day was spent hunting from 2000-2007 30

Table 14. The yearly mean and range in measured bull moose tip-to-tip antler spread (cm) from 1999-2007 31

Table 15. Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2007. 32

Table 16. Mean length (± SD) and range (in days) of goat hunts where at least one day was spent hunting from 2000-2007. 34

Table 17. Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, 1995-2007 38

Table 18. The number of reported observations of wolverine, the number of wolverine harvested, the number of hunters with wolverine tags, the percentage of total hunters with wolverine tags, and the total number of hunting tags purchased for 1995-2007. 40

Table 19. Observations of black bear reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2007 43

Table 20. Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2007; total number of bears observed, percent of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cubs/adults observed. [1] All bears were not separated out by cubs and adults. 47

INTRODUCTION

The 140 000 km^2 (54 000 mi^2; 34.6 million acres) area of the Mackenzie Mountains in the western Northwest Territories (NT) was first opened to non-subsistence hunters in 1965 (Simmons, 1968). Since then, the Mackenzies have become world-renowned for providing a high quality wilderness hunting experience, particularly for Dall's sheep (Veitch and Simmons, 1999). In return, non-resident hunters and outfitters in the Mackenzie Mountains provide an estimated $1.8 million annually to individuals, businesses, and governments in the NT (EXCELeration Corp., 2000). The outfitted hunting industry in the Mackenzie Mountains also provides employment for 100 to 120 outfitters, guides, pilots, camp cooks, camp helpers, and horse wranglers (Kelly Hougen, President, Association of Mackenzie Mountain Outfitters personal communication). Additionally, fresh meat from many of the harvested animals is provided to a number of local communities including Tulita, Fort Good Hope, and Norman Wells in the Sahtu and Nahanni Butte, Fort Liard and Fort Simpson in the Dehcho. This meat is distributed among local elders and residents and to health/long term care facilities.

Eight outfitters are currently licenced by the Government of the Northwest Territories (GNWT) to provide big game outfitting services within the Mackenzie Mountains (Fig. 1; Appendix 1). No hunting is permitted within the boundaries of Nahanni National Park Reserve in the southern half of the range, except for subsistence harvest by NT General Hunting Licence holders. Under the terms of the NT *Wildlife Act*, each licensed outfitter has the exclusive privilege to provide services within their zone,

which enhances the outfitters' ability to practice sustainable harvest through annual *allocation of the harvest effort*.

The hunting licence year in the NT runs from 01 July to 30 June and those who desire to hunt big game within the NT must annually obtain a big game hunting licence and must be at least 16 years old (Department of Environment and Natural Resources, 2007). There are four classes of licenced big game hunters in the NT:

1) *General* – subsistence harvesters, primarily Aboriginal people.
2) *Resident* - Canadian citizens or landed immigrants who have been living in the NT for at least two consecutive years prior to application for the licence.
3) *Non-resident* - Canadian citizens or landed immigrants who live outside the NT, or have not resided in the NT for a full two years prior to application for the licence.
4) *Non-resident Alien* - an individual who is neither an NT resident nor a non-resident.

Both non-residents and non-resident alien hunters must use the services of an outfitter and must be accompanied by a licenced guide at all times while hunting big game. For simplification in this report, we call both non-resident and non-resident alien hunting licence holders 'non-residents' and combine their harvest statistics. The data from 6 resident hunters, who harvested Dall's sheep in the Mackenzie Mountains without a guide, have been included in the number of sheep harvested and the age and horn length measurements in this report as indicated.

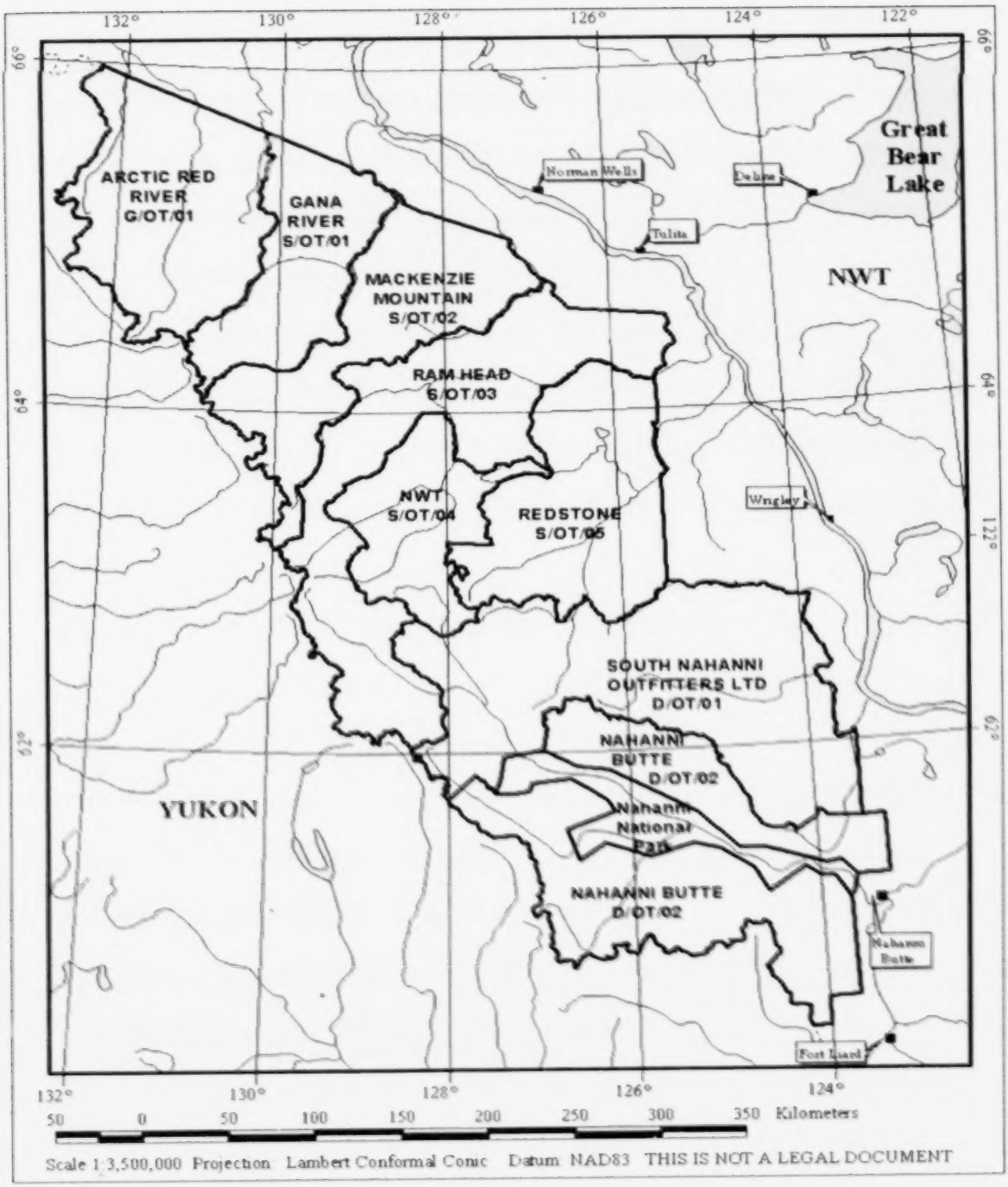

Figure 1. Outfitting zones in the Mackenzie Mountains, Northwest Territories – 2007.

Individual non-resident hunters are annually restricted to one each of the following big game species (Appendix 2): Dall's sheep (male with at least ¾ curl horns), mountain woodland caribou (either sex), moose (either sex), mountain goat (either sex), wolf (either sex), wolverine (either sex), and black bear (adult not accompanied by a cub or cubs). Although non-resident hunters are allowed to hunt female moose and caribou they prefer to hunt males for their trophy antlers. Non-resident hunting for grizzly bears was closed in 1982 as a result of concerns about over-harvest (Miller *et al.*, 1982; Latour and MacLean, 1994). There are currently no restrictions on the total number of each big game species that an outfitter can take within the zone for which they are licenced.

Wildlife management within the Mackenzie Mountains is the responsibility of a variety of government agencies and boards set up as a result of comprehensive land claim agreements. The Nahanni National Park Reserve (4766 km^2) in the south Mackenzie Mountains is managed by Parks Canada – an agency of the Canadian federal government. Under the terms of the *Sahtu Dene and Métis Comprehensive Land Claim Agreement* (signed in 1993) and the *Gwich'in Comprehensive Land Claim Agreement* (signed in 1992), primary responsibility for wildlife management within the two settlement areas lies with the Sahtu Renewable Resources Board (SRRB) and the Gwich'in Renewable Resource Board (GRRB), respectively. Approximately 68 000 km^2 of the central and northern Mackenzie Mountains are within the Sahtu Settlement Area and 8300 km^2 are within the Gwich'in Settlement Area, which encompasses the extreme north end of the range. However, the GNWT maintains ultimate jurisdiction for management of wildlife and wildlife habitat within each of the claim areas. The

Department of Environment and Natural Resources (ENR) of the GNWT is responsible for licencing outfitters, guides, and hunters and for annually monitoring non-resident big game harvest in the Mackenzie Mountains. Under the terms of the *Dehcho First Nations Interim Measures Agreement* (signed in 2001), ENR has primary responsibility for wildlife management within the Dehcho region (approximately 59 000 km^2) of the southern half of the Mackenzie Mountains.

Each year ENR, under provisions in the GNWT's *Wildlife Business Regulations*, requires that outfitters submit an Outfitter Return on Client Hunter Success form for each person that purchased a NT non-resident big game hunting licence (Fig. 2). These are known as outfitter return forms and they must be submitted whether or not a client actually hunted, and whether or not any game was harvested. The outfitter return forms allow us to quantify harvest by non-resident hunters to help biologists with the GRRB, SRRB, and ENR to ensure that the harvest of each species is within sustainable limits.

In 1995, the then Department of Renewable Resources requested that all non-resident hunters also fill out a voluntarily questionnaire. The questionnaire has changed and been revised through the years, having included different questions pertaining to wildlife observations, the quality of the hunting experience, the quality of services related to hunter travel, and an opportunity for specific comments by the hunter. One key component of the questionnaire that has remained throughout pertained to reporting the different types and numbers of wildlife seen during their hunts. These data have been recorded and the questionnaire forms have been and will be referred to as hunter observation forms in this report (Fig. 3).

This is the thirteenth consecutive year that a summary of the data collected by ENR on non-resident hunters in the Mackenzie Mountains has been made. In the text of this document, data for 1995 are found in Veitch and Popko (1996), for 1996 in Veitch and Popko (1997), for 1997 in Veitch and Simmons (1998), for 1998 in Veitch *et al.* 2000b, for 1999 and 2000 in Veitch and Simmons (2000a;b respectively), for 2001 by Veitch and Simmons (unpublished data), for 2002-2006 in Larter and Allaire (2003; 2004; 2005a; 2006; 2007 respectively). Additionally, Latour and MacLean (1994) summarized data for 1979 to 1990. This report compiles the harvest data collected during the 2007 hunting season and compares it with available data collected since 1995, and earlier when available.

Department of Resources, Wildlife and Economic Development
Département de Ressources, Faune et Développement économique
Pursuant to the **WILDLIFE ACT** - En Vertu De La **LOI SUR LA FAUNE**

Northwest Territories

OUTFITTER RETURN ON CLIENT HUNTER SUCCESS

RAPPORT DU POURVOYEUR SUR LES RÉSULTATS DE CHASSE D'UN CLIENT

OR 008291

INSTRUCTIONS: This form is to be completed as soon as practicable after the big game animal has been killed and is to be submitted before the 10th day of the following month to the Regional Bureau at.
Ce formulaire doit être rempli aussitôt que possible après l'abattage de gros gibier et doit être remis au bureau régional avant le dixième jour du mois suivant.

OUTFITTER/CLIENT HUNTER - POURVOYEUR/CLIENT CHASSEUR

Outfitter Name - Nom du pourvoyeur: Arctic Red River Outfitters

Client Hunter Last Name - Nom de famille du client chasseur: Hoffman

First Name - Prénom: Scott

Id. Number/No. - No. d'identité ou de passeport: B 705 870

RETURN FOR THE PERIOD OF - RAPPORT MENSUEL POUR

Month - Mois: Sept. / 02. 2002

BIG GAME HUNTED - GROS GIBIER CHASSÉ (If none killed, complete "No. of Days Hunted" for each species hunted - Si aucun animal n'a été abattu, remplir la partie "Nombre de jours à la chasse" pour chaque espèce chassée)

Species - Espèce	Tag No. N° de l'étiquette	No. of Days Hunted Nombre de jours à la chasser	Guide	Guide Lic. No. N° de licence du guide	Kill Date Date de l'abattage	Latitude	Longitude	Miscellaneous - Divers
WOODLAND CARIBOU CARIBOU DES BOIS	57048	12	TAWLIS MOLAAR	009693	21 09	65° 27'	131° 28'	Right Antler Length Longueur du bois droit 47 6 Left Antler Length Longueur du bois gauche 45 6
MOOSE ORIGNAL	63651	8	TAWLIS MOLAAR	009693	15 09	64° 26'	131° 42'	Widest Antler Spread Largeur à l'endroit le plus large 60 6
MOUNTAIN GOAT CHÈVRE DE MONTAGNE								Right Horn Length Longueur de la corne droit cm Left Horn Length Longueur de la corne gauche cm Sex - Sexe
POLAR BEAR OURS POLAIRE								Hide Length Longueur de la peau cm Sex - Sexe
BARREN GROUND CARIBOU CARIBOU DE LA TOUNDRA								Species - Espèce/No. Seen - Quantité observée/Sex - Sexe 12 3 1 moose
Other species - Autre préciser								21 caribou
Other species - Autre préciser								7 caribou
Other species - Autre préciser								7 / 30 cm ave (7356 lb, 52 inches)
Other species - Autre préciser								9 g1 bear (1 male)
DALL'S SHEEP MOUFLON DE DALL	18536 Tag No. - N° de l'étiquette	1 Cert. No. - N° de cert.	TAWLIS MOLAAR Other No. - Autre numéro	009693	09 09	64° 53'	131° 26'	27 inch, 3 6 curl / horn Spread - Largeur entre les cornes Broomed - Corne abîmée Right - Droit Left - Gauche

COMMENTS - COMMENTAIRES

We are interested in your observations of quantity and quality of wildlife observed, their location, condition, age, sex, species, etc. In addition, please comment on any unusual conditions (i.e. burns, pollution, etc.) or the harvested animals.

Nous sommes intéressés par vos observations qui nous aurez faites sur la quantité et la qualité de la faune, sa localisation, sa condition, l'âge, le sexe, les espèces, etc. De plus, nous saurez gré de vos commentaires sur les conditions inhabituelles observées sur des animaux abattus (brûlures, contamination, etc.)

OFFICE USE ONLY - RÉSERVÉ AU BUREAU

Export Permit No. - N° du permis d'exportation | Export Permit No. - N° du permis d'exportation | Duty Permit No. - N° du permis d'impôt

Checked By - Vérifié par | Date 20 | Entered By - Inscrit par | Date 20

NOTE: This form must be kept at all times by the hunter while in possession of game and is required by the Wildlife Act to be produced for inspection by any Conservation Officer. Failure to produce this form may result in prosecution.

NOTE: Cette formule doit être gardée par le chasseur en tout temps lorsqu'il est en possession de gibier et est requise par la Loi de la faune pour être présentée à un agent de conservation. Le défaut de produire cette formule peut entraîner des poursuites.

Signature: Scott Hoffman Date: 26 09 2002

Figure 2. Example of a completed Mackenzie Mountain Outfitter Hunt Report Form.

MACKENZIE MOUTAINS, NORTHWEST TERRITORIES
HUNTER WILDLIFE OBSERVATION REPORT – 2007

Dear Hunter: The Department of Environment and Natural Resources request your kind assistance with completing this questionnaire about your NWT hunting experience, in order to assist us with the management of Mackenzie Mountain big game populations. All the requested information is completely voluntary, but your providing it to us is most appreciated.

HUNTER INFORMATION

Last Name	First Name and Initials	
CLIFFORD	GREGORY P.	
Address- number and street, box number	**Town, City**	**Province, State, Country**
14 SAGE ROAD	LANDER	WYOMING USA

Hunting License # NL 715052 Outfitter Zone: Gloria Outfitter: NORTH FORD RIVER

Start Date of Hunt 7/15 2007 End Date of Hunt 7/24 2007 Observations Made Over 10 Days

ESTIMATED NUMBER OF DALL'S SHEEP SEEN			
¾ and Full Curl Rams	Less than ¾ Curl Rams	Ewes	Lambs
25	46	24	17

ESTIMATED NUMBER OF WOODLAND CARIBOU SEEN		
Bulls	Cows	Calves
2	1	1

ESTIMATED NUMBER OF MOOSE SEEN		
Bulls	Cows	Calves
0	0	0

ESTIMATED NUMBER OF MOUNTAIN GOAT SEEN			
Billys	Nannys	Kids	Unknown Age
0	0	0	0

Other Species						
	Wolf	Wolverine	Black Bear		Grizzly Bear	
			Adult	Cub	Adult	Cub
Number(s) Seen	3	0	0	0	1	0

How would you rate your overall hunting experience in the Mackenzie Mountains?
Excellent X Very Good ____ Good ____ Fair ____ Poor ____

How many times have you hunted in the Mackenzie Mountains, **including** this year's hunt? 2

Do you plan to return to hunt in the Mackenzie Mountains again? Yes X No ____

COMMENTS Excellent Area / outfitter

Thank You! Please give this form to the Officer or Clerk when you are exporting your trophies, or to the guide/outfitter with whom you hunted. We would appreciate receiving this form whether of not you harvested an animal(s).

Figure 3. Example of a fully completed Hunter Observation Report Form.

METHODS

Prior to the start of the 2007 hunting season, each outfitter in the Mackenzie Mountains received sufficient copies of the outfitter return and hunter observation forms for all their clients for the year. The *Wildlife Business Regulations* require outfitter returns to be returned by the tenth day of the month following the month of the hunt – e.g., for a hunter that was in the field in July, a form must be submitted by the 10th of August. Those forms were submitted to the senior biologist in either the Sahtu or the Dehcho whether or not a client actually hunted and whether or not harvest occurred. In co-operation with ENR Renewable Resource Officers and the outfitters, persistent attempts were made to obtain outfitter return forms for every non-resident that held a big game hunting licence through a Mackenzie Mountain outfitter in 2007.

Data from both the outfitter return forms and hunter observation forms were entered into *Excel 2000* (Microsoft Corporation, Seattle, WA) spreadsheets. Data were cross-checked with the records of sequentially numbered, unique identifier plugs inserted in the horns of legally harvested rams found in the License Information System-IntraNet (LIS-IN) data management system maintained by ENR offices across the Northwest Territories, and also with GNWT wildlife *Export Permit* forms to ensure that all data were verified and that the spreadsheets contained all appropriate available data required for the analyses.

We distributed new hunter observation forms in 2007 for consistency and we recorded all observations directly from these hunter observation forms. If we did not receive a hunter observation form, but wildlife observation data were recorded on the outfitter return form, we used these wildlife observation data. If observation information differed between the hunter observation form and the outfitter return form for the same

client we used the data from the hunter observation form. Occasionally we received identical observation data from forms of different hunters. These hunters had had the same guides and lengths of hunts and obviously had hunted together. We recorded forms with data that had been provided, but for the wildlife observation analyses only one set of these observations was used.

All descriptive statistical analyses were performed using *Excel 2000* (Microsoft Corporation, Seattle, WA). We present means ± standard deviation. Some statistical analyses were performed using Minitab 7.2 software (Minitab Inc, 1989).

RESULTS AND DISCUSSION

Hunters

Big game hunting licences for the Mackenzie Mountains were bought by 399 non-resident hunters in 2007 (Table 1). This is the second highest number of licenses sold since 1991 (Fig.4). Of those, 351 came to the NT and spent some time hunting; 48 either cancelled their hunts, decided not to hunt for themselves but participated with other hunters they knew, or decided not to hunt due to unforeseen complications after arriving in the NT. A majority of those that did not hunt were guides, who purchase licenses every year but rarely have the opportunity to hunt themselves. In 2007, licence sales to non-resident Canadians (n=88) was 22% of non-resident hunters, the same percentage as in 2006 and up from the 17% reported in 2005. We presume that the continued strengthening of the Canadian dollar is a major contributing factor to the number of Canadian sport hunters over the past few years. Guided hunts are marketed in American dollars. The number of foreign non-resident hunters in 2007 was slightly

lower than in 2006 (311 vs. 319), however for a fourth year there was an increase in the number of hunters from countries other than the United States, mostly Europeans and South Americans, which is responsible for some of the increase (Table 1). The recent change in ownership of South Nahanni Outfitters (D/OT/01) has resulted in an increased number of European and South American clients. Also, the American dollar has not fared as well against foreign currencies in recent years, which may make hunts more attractive to foreign clients.

We received all but 9 mandatory Outfitter Return forms for the 399 people that purchased non-resident licences. Voluntary Hunter Observation Report forms were received from 229 (65%) of the 351 that did at least some hunting in 2007 (Table 2). After consensus by outfitters at the 2003 annual general meeting of the Association of Mackenzie Mountain Outfitters to increase the number of Voluntary Hunter Observation Forms returned, the third year of *ca.* 65% return is discouraging. Most outfitters have endeavoured to have these forms completed and submitted but unfortunately two zones with fairly large clientele continue to be more lax in providing returns; we received only 5 of 58 forms from zone S/OT/03 and 19 of 63 forms from zone S/OT/02 in 2007. In order to be able to generalize observations over the entire Mackenzie Mountains, it is crucial that we receive representative observations from all outfitting zones; these 2 outfitter zones have the greatest north to south areas of all the zones. See Figure 3 as an example of a fully completed hunter observation form.

Table 1. Province, state and/or country of origin for the 399 non-residents who purchased licences for hunting in the Mackenzie Mountains, 2007

Canada		United States		Europe		Other	
Yukon	4	Eastern States[1]	118	Spain	12	Mexico	3
British Columbia	25			Germany	13	Chile	2
Alberta	51	Western States[2]	141	Austria	7	Australia	4
Saskatchewan	5			United Kingdom	3	South Africa	2
Manitoba	0			Switzerland	1	Argentina	1
Ontario/ Quebec	3			Czech Republic	2		
Atlantic Provinces	0			Portugal	1		
				Russia	1		
Total	88		259		40		12

[1] AL, AR, CT, DE, DC, FL, GA, IL, IN, IA, KY, LA, ME, MD, MA, MI, MN, MS, MO, NH, NJ, NY, NC, OH, PA, RI, SC, TN, VT, VA, WV, WI
[2] AK, AZ, CA, CO, HI, ID, KS, MT, NE, NV, NM, ND, OK, OR, SD, TX, UT, WA, WY

Table 2. Percentage of Mackenzie Mountain outfitter and non-resident hunter forms submitted, 1995-2007.

Form Type	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996	1995
Outfitter Return (mandatory)	98	99	100	99	98	95	92	96	96	97	98	100	98
Hunter Observation (voluntary)	65	64	65	74	60	59	57	53	51	60	50	71	80

It is obvious that non-resident hunters immensely enjoy their hunting experience in the Mackenzie Mountains (Table 3). In 2007, 93% of respondents rated their experience as either excellent (81%) or very good (12%). Not only do voluntary client comments made specific mention of the high quality of hunts (n=79), and the abundance of animals (n=34), (Appendices 3 and 4), but many comments make reference to 1) the professional and world class experience with their chosen guides, 2) the abundance of a wide variety of game species and predators, 3) the apparent health and condition of the game animals, 4) the pristine and scenic environment of the Mackenzie Mountains, and 5) compliments on the management and stewardship of the land. That is why two comments this year were of particular note. One was the positive identification of the presence of ticks in at least one Dall's sheep ram. The second was a complaint about an abundance of flagging tape left in trees, apparently by geologists remapping an area, which took away from the pristine environment and hunter's experience.

Since the inception of the voluntary hunter observation forms we consistently receive comments about grizzly bears, normally to do with their abundance, problems when encountered in and around camps, and the need for or want of a hunting season on grizzly bears. This year was no different (Appendices 3 and 4). Comments of high wolf numbers started in 2000 and continued through this year. Most reports about wolves were from zones G/OT/01, S/OT/01 and S/OT/04. There continued to be a few comments indicating dissatisfaction with expansion of Nahanni National Park.

It was the first time hunting in the Mackenzie Mountains for 172 of 239 (72%) respondents (including non-hunting guides). The 64 repeat hunters had hunted from 1-

17 times previously. Of 237 respondents (including non-hunting guides) 89% indicated they would like to return to the Mackenzies to hunt in the future.

This year, 69 Association of Mackenzie Mountain Outfitters meat forms were voluntarily submitted to ENR by some of the outfitters (D/OT/02, S/OT/03 and S/OT/05); a similar number of submissions as in previous years. These forms record the amount of meat (Dall's sheep, mountain caribou, moose, and mountain goat) taken from harvested animals and how the meat was utilized/distributed. Other outfitting zones do distribute meat to local communities, but the meat forms from outfitters in the Sahtu do not always get turned in and/or forwarded to the Dehcho ENR office. Some outfitters keep the meat forms for their own records in order to have them available for inspection by Renewable Resources Officers (Kelly Hougen, personal communication). We are trying to ensure that forms are available, get completed and submitted by the outfitters, and are forwarded. The distribution of wild meat by the outfitters is often a topic of heated local debate, and the collection of completed meat forms lets us quantify meat distribution to local communities. The provision of wild game meat by outfitters is an important and greatly appreciated local benefit.

Table 3. Satisfaction ratings for non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1996-2007.

Rating	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997	1996
Number of Hunters Reporting	239	230	256	229	191	193	191	158	157	202	144	224
Excellent (%)	81	80	90	84	82	82	75	76	73	80	78	77
Very Good (%)	12	16	7	10	15	15	16	17	20	17	17	17
Good (%)	5	3	2	5	3	3	6	6	5	2	3	2
Fair (%)	2	1	0	0	0	0	1	0	1	1	1	3
Poor (%)	0	0	0	1	0	0	1	1	2	0	1	1

Generally the majority of meat from harvested Dall's sheep and mountain goats is utilized in the outfitter camps. Nonetheless, at least 311 kg (683 pounds) from 57 harvested Dall's sheep and 99 kg (218 pounds) from 6 harvested mountain goats, were distributed locally. Mountain caribou and moose meat is also utilized in the camps, however a portion of the harvested mountain caribou and moose meat was distributed locally: at least 1383 kg (3043 pounds) from 19 mountain caribou and at least 1955 kg (4300 pounds) from 8 moose. Conservatively, the purchase of approximately 3748 kg (8244 pounds) of meat at retail outlets in local northern communities would cost a minimum of $74,960.

Once every 5 years the Department of Industry, Tourism, and Investment conducts an exit survey to determine where visitors to the Northwest Territories come from, their demographics, spending, and travel habits. In 2006 the exit survey was included in the package of outfitter return and voluntary hunter observation forms

provided to each outfitter for their clients. The inclusion of a second voluntary questionnaire was the source of discussion for outfitters, guides, and clients alike, with the most vocal complaints being the increased paperwork that had to be filled out. However, the addition of a second questionnaire did not appear to have affected the rate of return of voluntary hunter observation forms in 2007.

Some pertinent results from the 2006 exit survey include: 1) most (42%) hunters coming to the NT to hunt travel with friends, 2) most (45%) hunters planning on hunting in the NT decide 6-18 months prior to their hunt, 3) the main reason to hunt in the NT is the reputation of the outfitter (39%), and 4) the internet is the most sought after information source being used by 54% of hunters to plan their hunts (ITI, Tourism and Parks, unpublished data).

Dall's Sheep (*Ovis dalli dalli*)

Dall's sheep is one of the most desired species sought by non-resident hunters in the Mackenzie Mountains. Tags to hunt Dall's sheep were purchased by 266 (67%) non-resident hunters in 2007, similar to the 12-year average (Table 4). At least 81% of sheep tag holders pursued Dall's sheep and harvested 216 rams (including 6 resident hunters). The 2007 harvest was higher than the average number of 199 sheep harvested in the Mackenzie Mountains (1991-2006) (Fig. 4; Appendix 5). The mean (± SD) length of a sheep hunt in 2007 was 4.1 $\pm$ 2.6 days, similar to hunt lengths from 1997 to 2006 (Table 5), but less than the 5.3 day average from 1979-1990 (Latour and MacLean, 1994). Outfitted hunts in the Mackenzie Mountains are generally booked for 10 days; when hunters fill their sheep tag, any remaining time on the hunt is typically

spent in pursuit of other big game species for which tags are held, or in hunting small game.

Harvest by non-residents comprises at least 90% of the total annual harvest of Dall's sheep in the Mackenzie Mountains and takes only 0.8 to 1.5% of the estimated 14 000 to 26 000 Dall's sheep in the Mackenzie Mountains (Veitch *et al.*, 2000a). Therefore, the current non-resident harvest level appears well within sustainable limits, provided that hunting pressure is geographically distributed across each of the zones. In the Yukon Territory - where harvest is managed by a full curl rule - thinhorn sheep managers have set the sustainable harvest at 4% of the non-lamb population (Yukon Renewable Resources, 1996). In those areas of the Yukon where the management objective is to increase population size, harvest is limited to 2% of the total population.

There has been remarkable consistency in the mean outside contour length of the right horns from rams harvested by non-residents from 1972-2007, mean 89.1 ± 1.8 cm (SD) (Appendix 5; Table 6), which is surprising given the increase in average age of harvested sheep during that same period. We expected to see more broomed, or broken horn tips on older animals, since horn breakage generally occurs as a result of fights between rival males (Geist, 1993).

In 2007, brooming was noted on 32% of left and 28% of right horns from plugged trophies, similar to the 31% and 32% average of left and right horns reported over the past 11 years. One hundred and fifty-six (72%) of 216 harvested rams were at least 10-years-old. The mean age (± SD) of harvested rams was 10.8 ± 1.6 years (range 5.5 to 15.5 years; Table 7). This is the highest average age of harvested rams recorded in the Mackenzie Mountains since records have been kept (1967). This is the 20th

consecutive year where the reported mean age of harvested rams has been 9.5 years or older (Appendix 5). The 5.5 year-old male sheep harvested this year was mistakenly killed while hunting for another ram.

From hunters' classifications of sheep observed during their hunts in 2007 we calculated an estimated 63.9 lambs per 100 ewes. This is the highest lamb:ewe ratio reported since 1995 when records were started (Table 8; Appendix 6). For the Richardson Mountains of the northern Yukon and NT, Nagy and Carey (1991) suggest an August ratio of 43 lambs per 100 ewes would have allowed for their observed 10.5% average annual rate of increase from 1986 to 1991. Subsequent to a decline in this unhunted population from 1997-2003, Nagy *et al.* (in prep.) reported 28 lambs per 100 'nursery sheep' in August 2003. Jorgenson (1992) summarized 17 years of lamb:ewe classification data for a population of bighorn sheep in west-central Alberta and found a mean of 43 lambs per 100 ewes in September (range 25 to 54).

Differences in adult sex ratios among populations may result from differences in hunting pressure, differences in survival of males and females from birth to adulthood, or both (Nichols and Bunnell, 1999). However, since the ratio of rams to ewes is almost never equal in wild populations of mountain sheep, even where they are unhunted, it is clear that there is a different natural mortality rate for the two sexes. Geist (1971) suggested that this difference is a result of injuries and stress accumulated by males during the breeding season.

Table 4. Tags for big game species purchased by non-resident hunters with outfitters in the Mackenzie Mountains, 1995-2007.

Species	2007 399 hunters		2006 407 hunters		2005 394 hunters		2004 337 hunters		2003 347 hunters		2002 329 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	266	67	276	68	246	62	229	68	257	74	218	66
Mountain Caribou	272	68	274	67	285	72	243	72	247	71	229	69
Moose	108	27	112	28	101	26	84	25	85	24	68	21
Mountain Goat	50	13	21	5	40	10	24	7	18	5	18	5
Wolf	227	57	201	49	214	51	166	49	207	60	159	48
Wolverine	150	38	108	27	154	39	89	26	141	40	97	29
Black Bear	7	2	3	1	40	10	8	2	9	3	3	1

Species	2001 339 hunters		2000 332 hunters		1999 321 hunters		1998 345 hunters		1997 352 hunters		1996 387 hunters		1995 343 hunters	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Dall's Sheep	220	65	231	70	227	71	246	71	252	72	252	65	218	64
Mountain Caribou	201	59	206	62	181	56	223	65	260	74	274	71	233	68
Moose	65	19	69	21	63	20	69	20	73	21	74	18	70	20
Mountain Goat	12	4	12	4	6	2	23	7	30	8	14	4	16	5
Wolf	137	40	155	47	89	28	165	48	209	59	193	50	72	21
Wolverine	83	25	85	26	65	20	99	29	135	38	114	30	35	10
Black Bear	0	0	6	2	2	<1	2	<1	8	2	0	0	0	0

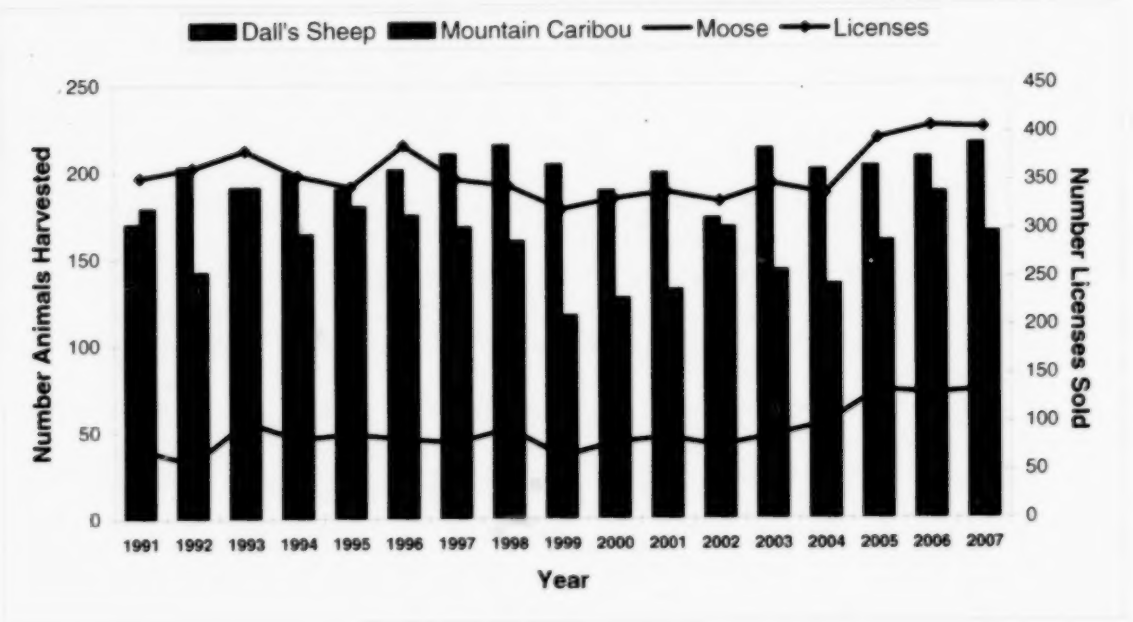

Figure 4. The number of Dall's sheep, moutain caribou, and moose harvested in the Mackenzie Mountains by non-resident hunters, and the number of non-resident licences sold during 1991-2007.

Table 5. Mean length (± SD) and range (in days) of Dall's sheep hunts where at least one day was spent hunting from 1997-2007.

	2007	2006	2005	2004	2003	2002	2001	2000	1999	1998	1997
Number of reports	216	214	190	167	189	174	176	198	201	224	216
Mean hunt length	4.1	4.1	4.1	4.0	3.8	4.7	4.8	4.6	4.7	4.4	4.3
Standard deviation	± 2.6	± 2.7	± 2.6	± 2.9	± 2.9	± 2.7	± 3.0	± 2.7	± 3.1	± 2.8	± 2.6
Range	1-13	1-12	1-14	1-17	1-12	1-12	1-15	1-15	1-16	1-15	1-12

Table 6. Horn measurements of Dall's sheep rams harvested in the Mackenzie Mountains, 2007.

	Left Horn Contour Length		Right Horn Contour Length		Left Horn Base Circumference		Right Horn Base Circumference		Tip To Tip Spread	
	cm	in	cm	in	cm	in	cm	in	cm	in
Mean	87.8	34.6	88.3	34.8	32.6	12.8	32.6	12.8	57.5	22.6
Standard Deviation	8.4	3.3	7.7	3.0	1.7	0.67	1.9	0.75	17.6	6.9
Maximum	106.5	41.9	106.0	41.7	36.8	14.5	37.0	14.6	77.0	30.3
Minimum	50.0	19.7	58.9	23.2	28.0	11.0	28.0	11.0	36.0	14.2

The 83.2:100 ram to ewe ratio (ram:ewe) estimated from hunters' observations in 2007 is similar to that reported from 1995-2003 but lower than 2004-2006 (Appendix 6). In 2004, 2005 and 2006 there were more rams with <¾ curl than rams with >¾ curl observed, and the lamb:100 ewes recorded in 2002 was high in the southern Mackenzie Mountains (Larter and Allaire, 2005b). Strong cohorts of juvenile rams may be a factor in the recent higher ram:ewe ratios reported.

In the Yukon, mid to late June annual aerial surveys to count and classify sheep from 1973 to 1998 reported a mean of 48 rams (range 28 to 74) per 100 'nursery sheep' (Jean Carey, Yukon Dept. of Renewable Resources unpublished data). For the unhunted Richardson Mountains herd (Yukon-Northwest Territories), Nagy *et al.* (in prep.) reported 41 rams per 100 'nursery sheep' in 2003 following a decline from peak population size in 1997. In Alaska, ram:ewe for two unhunted herds in Denali and Gates of the Arctic National Parks typically averaged 60-67:100 (Nichols and Bunnell 1999). In more heavily hunted Alaskan herds, ram:ewe ranged from 33:100 (heavily hunted) to 87:100 (lightly hunted). The ram:ewe ratios reported for the Mackenzie

Table 7. Age-structure of Dall's sheep rams harvested by non-resident and resident (n=6) hunters in the Mackenzie Mountains, 1995-2007.

	2007		2006		2005		2004		2003		2002		2001		2000		1999		1998		1997		1996		1995	
Age	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
3.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0
4.5	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
5.5	1	0.5	0	0.0	0	0.0	1	0.5	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	1	0.5
6.5	2	0.9	1	0.5	1	0.5	3	1.5	8	3.8	2	1.2	4	2.2	3	1.6	1	0.5	4	2.0	1	0.5	5	2.5	4	2.1
7.5	7	3.2	8	3.8	11	5.6	14	7.0	12	5.7	6	3.6	15	8.2	16	8.5	13	7.1	9	4.3	12	5.8	21	10.5	16	8.5
8.5	17	7.9	26	13.9	24	12.2	41	20.0	43	20.5	44	26.5	33	18.0	39	20.8	23	12.6	39	18.8	39	18.8	47	23.5	49	25.9
9.5	33	15.3	49	25.5	54	27.6	49	24.5	72	34.3	43	25.9	41	22.4	40	21.2	49	26.8	45	21.7	52	25.1	56	28.0	51	27.0
10.5	54	25.0	54	26.4	47	24.0	43	21.5	45	21.4	39	23.5	45	24.6	41	21.8	47	25.7	63	30.4	58	28.0	36	18.0	34	18.0
11.5	65	30.1	36	17.8	39	19.9	27	13.2	11	5.2	16	9.6	29	15.9	28	14.9	29	15.8	30	14.5	24	11.6	26	13.0	14	7.4
12.5	19	8.9	23	12.0	13	6.6	16	7.8	12	5.7	9	5.4	11	6.0	14	7.5	15	8.2	12	5.8	15	7.2	6	3.0	14	7.4
13.5	15	6.9	6	2.9	5	2.6	3	1.5	2	1.0	6	3.6	10	5.5	3	1.6	6	3.3	2	1.0	4	1.9	1	0.5	5	2.6
14.5	2	0.9	1	0.5	1	0.5	3	1.5	3	1.4	1	0.6	0	0.0	3	1.6	0	0.0	1	0.5	2	1.0	0	0.0	1	0.5
15.5	1	0.5	2	1.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0
16.5	0	0.0	0	0.0	0	0.0	0	0.0	1	0.5	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
>10y	156		122		105		92		74		71		95		90		97		109		102		69		68	
%>10	72.2		59.2		53.6		46.0		35.2		42.7		51.0		47.9		53.0		52.6		49.5		34.5		36.0	
>12y	37		32		19		22		18		16		21		21		21		16		21		7		20	
%>12	17.1		15.5		9.7		11.0		8.6		9.6		11.2		11.2		11.4		7.7		10.1		3.5		10.6	

Mountains since 1995 (Appendix 6) suggests that the harvest of rams in the Mackenzie Mountains is sustainable at current levels.

Table 8. Observations of Dall's sheep reported by non-resident hunters in the Mackenzie Mountains, 2007.

	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Sheep Classified
Rams	187	4425	23.7	33.7
Ewes[1]	171	5318	31.1	40.5
Lambs	168	3399	20.2	25.9

[1] includes females >1-yr-old, yearlings, and younger rams. Also called 'nursery sheep'.

In 2007, hunters observed similar numbers of rams (4425) to previous years (Tables 8, 9). They observed slightly fewer legal (>¾ curl) rams (n=1902) than rams with <¾ curl (n=2266) during their hunts (the curl of 257 rams couldn't be determined). The mean number of legal rams observed per hunt was 11.0 (Table 9).

Hunter observations this year provided us with the first confirmation of ticks infesting animals; one ram had 30+ ticks on it but otherwise appeared very healthy. Another interesting comment from a guide was that he saw 2 lambs with black tails.

Table 9. Classification of Dall's sheep rams observed by non-resident hunters in the Mackenzie Mountains, 1995 - 2007.

Ram Class	2007		2006		2005		2004		2003		2002	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	150	168	180	171	186	182	188	183	127	121	148	133
Number of rams classified	1902	2266	1769	2019	1787	1899	2185	2324	1662	1654	1720	1720
Percent of rams classified	45.6	54.4	46.7	53.3	48.5	51.5	48.5	51.5	50.1	49.9	50.0	50.0
Mean number of rams observed/hunt	11.0	13.5	9.9	12.0	9.6	10.4	11.6	12.7	11.9	11.9	11.6	12.9

Ram Class	2001		2000		1999		1998		1997		1996		1995	
	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl	Horn >¾ curl	Horn <¾ curl
Number of hunters reporting	186	174	151	147	144	138	177	177	205	205	172	174	181	180
Number of rams classified	1812	1765	1351	1717	1579	1756	1848	1924	1538	1586	1713	1699	2070	1645
Percent of rams classified	50.7	49.3	44.0	56.0	47.3	52.7	49.0	51.0	49.2	50.8	50.2	49.8	55.7	44.3
Mean number of rams observed/hunt	9.7	10.1	8.9	11.7	11.0	12.7	10.4	11.3	7.5	7.7	10.0	9.8	11.4	9.1

Mountain Caribou (*Rangifer tarandus caribou*)

Mountain caribou are another of the more desired species sought by non-resident hunters. Tags were purchased by 272 (68%) non-resident hunters (Table 4), and at least 61% of tag holders hunted caribou harvesting 165 bulls. The harvest in 2007 falls slightly above the mean annual harvest of 158 (range 117-191) recorded from 1991-2007 (Fig. 4; Appendix 7). The mean (±SD) length of a mountain caribou hunt, determined from the 172 reports where hunters spent at least 1 day hunting, was 4.04 ± 3.2 days (range 1-16 days). This is similar to the mean annual hunt lengths from 2000-2006 (Table 10).

From hunters' classifications of mountain caribou observed during their hunts, we calculated ratios of 52.3 calves and 36.6 bulls per 100 adult females (cows); bulls comprised 19.4% of all caribou classified (Table 11). The calf:cow ratio for 2007 is somewhat higher than average (range 36-59:100 since 1995) while the bull:cow ratio matches the mean (1995-2007; Appendix 6).

Table 10. Mean length (± SD) and range (in days) of mountain caribou hunts where at least one day was spent hunting from 2000-2007.

	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	172	171	191	120	172	181	178	141
Mean hunt length	4.0	4.3	3.7	4.9	3.8	3.6	4.3	4.0
Standard deviation	± 3.2	± 3.1	± 3.8	± 3.9	± 2.8	± 2.7	± 3.2	± 2.7
Range	1-16	1-14	1-32	1-34	1-14	1-12	1-15	1-12

Table 11. Observations of mountain caribou reported by non-resident hunters in the Mackenzie Mountains, 2007.

Sex/Age Class	Number of Hunters Reporting	Number Observed	Mean Number Observed/hunter	Percent of Total Classified
Bulls	185	4547	24.6	19.4
Cows	182	12418	68.2	52.9
Calves	160	6496	40.6	27.7

In 2007 we received antler lengths from 127 (77%) of successful hunters; a similar percentage as in previous years. This year, as in other years, there was substantial variation in antler lengths, range 77.5-144.8 cm (31-52 in.). The maximum left and right antler lengths reported were 144.8 and 141.0 cm respectively (Table 12). The maximum antler length recorded by Boone and Crockett for mountain woodland caribou in North America is 158.5 cm (62.4 in) for a caribou taken from the Mackenzie Mountains in 1978 (Byers and Bettas, 1999). Fourteen of the top 50 mountain woodland caribou recorded in the 12th edition of the Boone and Crockett Club record book are from the Mackenzie Mountains; the highest scoring antlers hold 7th place (Boone and Crockett Club on-line trophy database accessed 2007).

Table 12. Antler measurements of mountain caribou bulls harvested by non-resident hunters in the Mackenzie Mountains, 2007.

	Contour Length	
	Left Antler	Right Antler
Number Measured	127	127
Mean (cm)	115.9	116.1
Mean (in)	45.6	45.7
Standard Deviation (cm)	18.0	18.1
Standard Deviation (in)	7.1	7.1
Maximum (cm)	144.8	141.0
Maximum (in)	57.0	55.5
Minimum (cm)	78.7	77.5
Minimum (in)	31.0	30.5

Another measuring system for antlered animals is from Safari Club International (SCI), which has a unique all-inclusive record keeping system for measuring trophies; the most used system in the world. Unlike Boone and Crockett, this system has no deductions or penalizing for asymmetry. Some outfitters prefer using this measuring system, especially for caribou, because it provides points for all tines and there are no deductions, (Jim Lancaster, personal communication). Ten of the top 20 mountain woodland caribou recorded in the Safari Club International record book are from the Mackenzie Mountains with a caribou harvested in 2006 holding 2nd place in scoring (Safari Club International on-line trophy database accessed 2008).

Over the past 5 years bulls have comprised *ca.* 22% of the observed mountain caribou in the Mackenzie Mountains. This is a consistently lower percentage than the cumulative 39% average adult bull component reported by Bergerud (1978) in his

summary of 8 North American caribou populations that were either non-hunted or hunted non-selectively (i.e., both males and females included in the harvest). Veitch *et al.* (2000c) classified 2659 of an estimated 5000 caribou in the central Mackenzie Mountains in August 1999 and reported only 25% of those animals were classified as males. Surveys made on the rutting grounds of the South Nahanni caribou herd provided in 1995, 1996, and 1997 reported 24, 28, and 20% of animals classified as males ≥1-year-old (Gullickson and Marsteau, 2000) and in 2001 reported 27% bulls (Gunn *et al.*, 2002). A 2007 survey during the rut estimated 33 bulls:100 adult cows (P. Farnell and K. Egli Yukon Territorial Government unpublished data). Therefore, further investigation is warranted to determine the reason for the consistently lower bull:cow ratios reported for caribou in the Mackenzie Mountains.

In their 2002 assessment, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assessed the boreal population of woodland caribou as "threatened" and the Northern Mountain population of woodland caribou as "special concern". These two populations of woodland caribou were subsequently listed under the federal Species at Risk Act in 2004, 2005 and 2006 respectively. Caribou of the Mackenzie Mountains are part of the Northern Mountain population of woodland caribou. In order to be more specific and to avoid confusion this report will use "mountain caribou" when referring to caribou from the Mackenzie Mountains.

Caribou in the Mackenzie Mountains are estimated to number between 13 000 and 18 000 from at least 3 separate herds shared between the Yukon and Northwest Territories: Bonnet Plume herd (5000 estimated), the greater Redstone herd (5-10 000 estimated), and the greater Nahanni herd (2-3000 estimated) (Jan Adamczewski, personal communication; Mark O'Donoghue, personal communication; Alasdair Veitch,

personal communication). They are subjected to an annual bull-selective non-resident harvest averaging just 158 males per year (1991-2007). The resident harvest of mountain caribou in the Mackenzie Mountains also tends to be bull-selective (but not restricted to bulls) and is generally light (i.e., 30 animals/year); subsistence harvest includes both males and females, with the proportion of each dependent on the time of year that animals are harvested (J. Svoboda, unpublished data; Ken Zaidlicz, personal communication). Subsistence harvesters in the Mackenzie Mountains include residents of both the NT and Yukon Territory; harvest is not generally reported.

Studies on the Redstone herd of mountain caribou were initiated in March 2002, with 10 female caribou being equipped with satellite radio collars as part of a study of caribou in the central and north-central Mackenzie Mountains initiated by the Sahtu Renewable Resources Board (Creighton 2006; Olsen 2000; 2001; Olsen *et al.*, 2001). Satellite radio collars were deployed on 9 adult female caribou during March 2000 and October 2001 by the Yukon Department of the Environment (Jan Adamczewski, personal communication). These animals were believed to be part of the greater Nahanni herd. In October 2004, 18 female caribou were equipped with satellite collars along the Yukon-Northwest Territories border. These caribou were also believed to be from the greater Nahanni herds, but 3 animals were determined to be from the Finlayson herd. This is a co-operative study between Yukon Territorial Government, Parks Canada (Nahanni National Park) and the Wildlife Conservation Society (Weaver, 2006).

Alaska-Yukon Moose (*Alces alces gigas*)

Moose in the Mackenzie Mountains belong to the Alaska-Yukon subspecies of moose (also known as tundra moose) that occur across Alaska, the Yukon, extreme northern British Columbia, and the Mackenzie Mountains, with the Mackenzies representing the eastern limit of the subspecies' range. This is the largest of the four subspecies of moose that occur in North America (Bubenik, 1997). Tags to hunt moose were purchased by 27% (n=108) of non-resident hunters in 2007 (Table 4). At least 69% of tag holders hunted moose and harvested 74 bulls. The number of moose harvested in 2007 equals the highest level reported previously in 2005, and is greater than the mean annual harvest of 50 from 1991-2007 (Fig. 4; Appendix 7). The mean (± SD) length of a moose hunt, determined from the 80 reports where hunters spent at least 1 day hunting, was 4.0 ± 2.5 days (range 1-9 days), similar to what was reported for previous years (Table 13).

Table 13. Mean length (± SD) and range (in days) of moose hunts where at least one day was spent hunting from 2000-2007.

	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	80	72	85	49	60	46	42	48
Mean hunt length	4.0	3.6	4.4	4.8	3.9	3.6	3.7	4.4
Standard deviation	±2.5	±2.7	±3.1	±3.3	±2.8	±2.6	±2.9	±2.7
Range	1-9	1-11	1-14	1-12	1-14	1-12	1-12	1-12

The higher numbers of moose harvested in recent years is likely in part related to the change in ownership of outfitting zone D/OT/01. This zone is one of the largest with an abundance of good moose habitat. Prior to 2005 few moose were harvested in

this zone annually (<4 moose/year 1991-2004) because the majority of clients were not interested in moose hunting. Subsequently, the new owner has a client base which includes a large number of European hunters who are specifically looking for trophy moose for European mounts.

The mean (± SD) tip-to-tip spread of measured antlers from bull moose harvested by non-resident hunters in 2007 was 141.1 ± 17.2 cm (55.6 ± 6.8 in., n=62). This year we received the greatest number of antler measurements from outfitters (Table 14). This year's maximum recorded antler spread was 179.0 cm (70.5 in.), slightly less than the maximum recorded antler spread of 188.00 cm (74 in.) for a record Alaska-Yukon moose taken in the NT in 1996. Two moose taken from the Mackenzie Mountains are in the top 20 Alaska-Yukon moose recorded in the record book of the Boone and Crockett Club and hold places 14 and 19 (Byers and Bettas, 1999); the rest of the top 20 were all taken in Alaska and the Yukon.

Table 14. The yearly mean and range in measured bull moose tip-to-tip antler spread (cm) from 1999-2007.

	2007	2006	2005	2004	2003	2002	2001	2000	1999
Measured (n)	62	56	53	38	34	32	32	34	26
Average spread	141.1	141.3	144.9	150.3	150.0	149.3	144.3	147.0	144.2
Range	102 – 179	107 – 170	122 – 188	127 – 174	107 – 165	105 – 178	113 – 165	127 – 179	109 – 166

From hunters' observations of moose during hunts we calculated ratios of 35.6 calves:100 adult females (cows) and 100.7 bulls:100 cows (Table 15; Appendix 6). This is the highest calf:cow ratio recorded since 1995 and the seventh time in the past 13 years when the ratio has been ≥30:100. The ratio still remains lower than the 40-

60:100 that is generally documented during early to mid-winter aerial surveys for northwestern moose (*Alces alces andersoni*) along the Mackenzie River in the vicinity of the communities of Fort Good Hope (MacLean, 1994a), Norman Wells (Veitch *et al.*, 1996), and Tulita (MacLean, 1994b) (Appendix 6). However, these surveys are conducted after the major fall subsistence harvest and variable female harvest can certainly impact the interpretation of calf:cow ratios. No research has been done on moose in the Mackenzie Mountains therefore we have no explanation for the apparent discrepancy in calf production, survival, or both between the mountains and the river valley. A survey of moose in the Norman Wells study area in January 2001 estimated a calf:cow ratio of 18:100 (ENR, Norman Wells unpublished data), and an aerial survey of the Mackenzie River Valley and vicinity in the Dehcho Region south from the Blackwater River to Jean Marie River conducted in November 2003 estimated 32:100 (N. Larter, unpublished data), indicating that low calf:cow ratios may not be restricted to the Mackenzie Mountains and that more study is required to determine the cause(s). A program has recently been established in the Mackenzie and Liard River Valleys of the Dehcho to document calf:cow ratios annually in November (ENR, Fort Simpson unpublished data).

Table 15. Observations of moose reported by non-resident hunters in the Mackenzie Mountains, 2007.

Age/Sex class	Number of Hunters Reporting	Number Observed	Mean Number Observed/Hunter	Percent of Total Classified
Bulls	104	435	4.2	42.6
Cows	97	432	4.5	42.3
Calves	61	154	2.5	15.1

The bull:cow ratio of 101:100 reported for 2007 is similar to the 104:100 average from 1995-2006 (range 76-137:100; Appendix 6). Bull:cow ratios from the Mackenzie Mountains continue to be generally higher than the range of 27-105:100 reported in the Yukon (R. Ward cited in Schwartz 1997) and from heavily harvested populations in Alaska of 16:100 (Schwartz *et al.*, 1992) and Norway of average 46:100, range (25-69:100) (Solberg *et al.*, 2002). There has been concern that low bull:cow ratios could influence conception dates, pregnancy rates and newborn sex ratios (Bishop and Rausch, 1974; Crête *et al.*, 1981; Solberg *et al.*, 2002) and that management strategies should maintain a high bull:cow ratio (Bubenik, 1972). Studies on tundra moose in Alaska have not found evidence that moose populations with low bull:cow ratios have reduced reproductive rates (Schwartz *et al.*, 1992); populations with a more skewed sex ratio had a relative rate of population increase greater than populations without a skewed sex ratio (Van Ballenberghe, 1983). However, a recent study of 8 heavily harvested moose populations in Norway indicated a relationship between declining recruitment rate and skewed adult sex ratio (Solberg *et al.*, 2002). Based upon hunter observations since 1995, there is no indication of any decreasing trend in the bull:cow ratio of moose in the Mackenzie Mountains hence the adult sex ratios are an unlikely factor in the low calf:cow ratios reported. The reported sex ratios may have an inherent bias towards a greater number of bulls if harvesters consistently spend more time searching for moose in areas frequented more by large males than females.

Mountain Goat (*Oreamnos americanus*)

Sales of mountain goat tags show more annual fluctuation than any other ungulate species harvested by non-resident hunters in the Mackenzie Mountains; range 6-40 (1995-2006; Table 4) with a mean annual harvest of 7 goats (range 1-18) over the same time (Appendix 7). In 2007, mountain goat tags were purchased by 50 (13%) non-resident hunters. Twenty-one goats were harvested in 2007; 17 billies, 3 nannies and 1 of unreported sex (Table 4). This was the highest harvest of mountain goats from 1991-2007. This year one harvested nanny fell from a cliffside and was unretrievable. The mean (± SD) length of a goat hunt, determined from the 27 reports where hunters spent at least 1 day hunting, was 2.7 ± 1.7 days (range 1-6 days), similar to last year, but somewhat lower than 2004 and 2005 (Table 16).

Table 16. Mean length (± SD) and range (in days) of goat hunts where at least one day was spent hunting from 2000-2007.

	2007	2006	2005	2004	2003	2002	2001	2000
Number reports	27	12	18	8	6	4	2	1
Mean hunt length	2.7	2.8	3.8	3.9	3.0	2.8	1.5	3.0
Standard deviation	± 1.7	± 1.5	± 2.8	± 1.6	± 2.6	± 1.9	± 0.7	nil
Range	1-6	2-6	1-14	2-6	1-8	1-5	1-2	3

Mountain goats are known to inhabit 5 of the 8 outfitting zones in the Mackenzie Mountains, occurring almost exclusively below 63° 00' N (Veitch *et al.*, 2002). They are most numerous in high relief terrain along the Yukon-Northwest Territories border between 61° 00' and 62° 00' N. However, since 1995 we have received hunter observations or harvest reports of goats from only 4 of those outfitter

zones - D/OT/01, D/OT/02, S/OT/03, and S/OT/04 (see Fig. 1). In 2007, observations of mountain goats by hunters came from just 2 of those zones D/OT/01 (n=102) and D/OT/02 (n=291), but goats were harvested from 3 zones including S/OT/03. Additional information about goats from S/OT/03 would be most useful. We estimated 71.2 kids and 57.7 billies per 100 nannies based upon this year's hunter observations.

In 2005 we started to estimate the age of harvested goats based on counting horn annuli and have tried to age as many harvested goats as possible since then. Of the 42 goat (36 billies and 6 nannies) ages we have to date the range has been from 2.5 to 15.5 years with 23 aged <8 years and 19 aged >8 years (Fig. 5). Of the 19 goats (17 billies and 2 nannies) aged in 2007, 2 were aged >12 years. The largest horns from a mountain goat taken in 2007 were 25.5 cm (left) and 25.3 cm (right). No mountain goats from the NT are listed in the 11th edition of the Boone and Crockett Club record book (Byers and Bettas, 1999). Based upon the horn age and length data over the past 3 years there is a somewhat linear relationship between age and horn length from 2.5-7.5 years but after that age there is almost no relationship implying that large horned animals are found over a wide range in animal ages (Fig. 5).

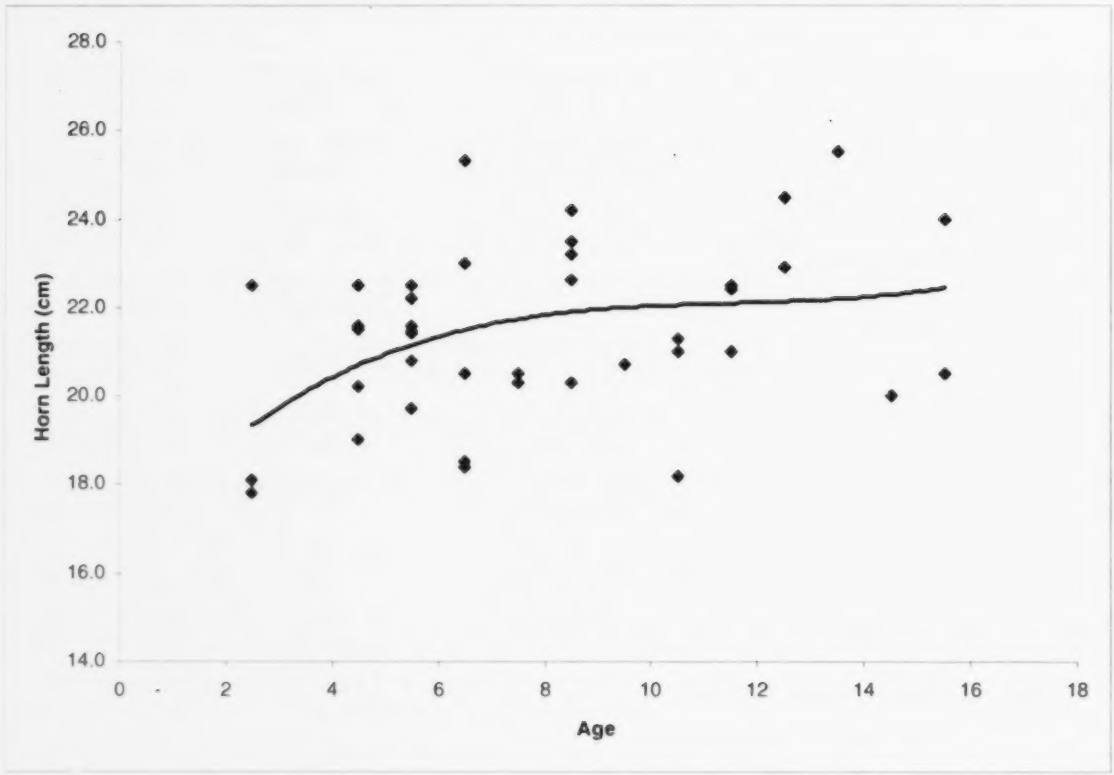

Figure 5. The relationship between the horn length (cm) and age (based upon horn annuli) of 42 mountain goats harvested in the Mackenzie Mountains 2005-2007. Line of best fit is a 3rd order polynomial.

There is some evidence that goat numbers and distribution have been increasing in zone D/OT/02 in the southern Mackenzie Mountains (Larter, 2004; Cam and Clay Lancaster, personal communication). Although the 65.6 kids and 58.4 billes per 100 nannies reported from hunter observations in this zone is slightly lower than that reported over the past 2 years, and lower than that reported from hunter observations in zone D/OT/01 in 2007, the total number of goats observed increased and billies were observed in places they had not been seen previously in zone D/OT/02 (Clay Lancaster, personal communication).

In a 2.5 hour rotary-winged survey of zone D/OT/02 on 11 September 2006, 88 goats were observed (38 billies, 27 nannies, 19 kids, and 4 yearlings), producing population estimates of 140.8 billies and 70.4 kids per 100 nannies (N. Larter, unpublished data). This survey was conducted in an area that could not be surveyed during a 2004 aerial survey and provided similar numbers of goats and ratio estimates as the 111 billies and 71.4 kids per 100 nannies from the 2004 survey (Larter, 2004). These observations support the contention of increasing goat numbers and distribution.

The recent increase in the number of mountain goats harvested (see Appendix 7) may be related to changes in accessibility to the more remote and rugged parts of the various outfitter ranges where goats are resident. The use of rotary aircraft in recent years has permitted outfitters to get into some areas of their zones where they have never been before, areas where goats have been found. This accessibility to increased areas of untouched goat range has likely had some effect on the increased success in goat harvest.

Wolf (*Canis lupus*)

Wolf tags were purchased by 57% of non-resident hunters in 2007 (Table 4) with 12 wolves harvested (Appendix 7). The wolf harvest was similar to that from 1991-2006 (mean 13, range 7-23). The number of wolves observed in 2007 (n=262) was similar to observations in previous years (Table 17). Only 1% of responding hunters indicated that they believed wolf numbers were high, similar to 2003-2005 but less than that reported for 2000, 2002 and 2006 respectively. 2000 was the first year that hunters commented on wolf numbers in the wildlife observation forms.

The number of hunters reporting since 2001 has been consistently higher than in previous years. This we attribute to a change in how we defined hunter reporting. For data collected after 2001, we assumed that all returned observation forms where there was a blank, a zero, or a dash in the box indicating the number of wolves observed was a report of no wolves being observed. When looking at the forms this seemed like a reasonable assumption. This assumption may well be invalid for previous years' data and would bias the post 2001 values to be higher than the previous years.

Table 17. Observations of wolves reported by non-resident hunters in the Mackenzie Mountains, 1995-2007.

	2007[1]	2006[1]	2005[1]	2004[1]	2003[1]	2002[1]	2001	2000	1999	1998	1997	1996	1
Number hunters reporting	244	239	254	244	203	197	142	116	103	148	141	76	
Number wolves observed	262	202	245	317	200	249	215	228	142	148	200	186	2
Mean observed/hunter	1.1	0.8	1.0	1.3	1.0	1.3	1.5	2.0	1.4	1.0	1.4	2.4	
Number hunters seeing ≥1	88	84	76	81	74	69	65	61	40	57	76	26	

[1] Change in reporting since 2002 may have resulted in the number of hunters reporting for 1995-2001 being artificially low, see text

Wolverine (*Gulo gulo*)

Wolverine tags were purchased by 38% (n=150) of non-resident hunters (Table 4). At least 21% (n=32) of tag holders actively hunted wolverines, but none were harvested in 2007. Hunters reported spending from 1-16 days actively hunting

wolverine (mean ± SD of 5.9 ± 3.8 days). Hunters reported 13 observations of wolverines. Observations were reported from 6 of the 8 outfitter zones, but most observations came from D/OT/01, D/OT/02 and G/OT/01 (Fig. 6). All observations were of individual animals. Historically, wolverine observations have been mostly of solitary animals with few family groups being observed. The number of animals observed this year is similar to the lower levels reported from 2000-2003, and less than the 20-35 observed during 1995-1999 and 2004-2006 (Table 18; Fig. 6). It is believed that wolverine numbers in other parts of their range in the Northwest Territories may be declining and our reduced number of observations may be consistent with these findings (Suzanne Carrière, personal communication).

There is no relationship between the number of wolverine observed/year and annual harvest nor do the number of tags purchased/year explain annual differences in wolverine observations (Table 18). Wolverines occur throughout the Mackenzie Mountains, but sightings are considered rare. Most wolverine observations are made in hunting zones D/OT/01, D/OT/02, G/OT/01, S/OT/01, and S/OT/04.

Table 18. The number of reported observations of wolverine, the number of wolverine harvested, the number of hunters with wolverine tags, the percentage of total hunters with wolverine tags, and the total number of hunting tags purchased for 1995-2007.

Year	2007	2006	2005	2004	2003	2002
Reported Observed	13	25	28	30	12	9
Number Harvested	0	1	1	0	0	1
No. Wolverine Tags	150	108	154	89	141	97
% Wolverine Tags	38	27	39	26	40	29
Total Hunting Tags	399	407	394	337	347	338

Year	2001	2000	1999	1998	1997	1996	1995
Reported Observations	9	11	30	34	36	34	21
Number Harvested	2	0	3	0	1	4	1
No. Wolverine Tags	83	78	65	99	135	114	35
% Wolverine Tags	26	23	20	29	38	29	11
Total Hunting Tags	344	332	321	345	352	387	333

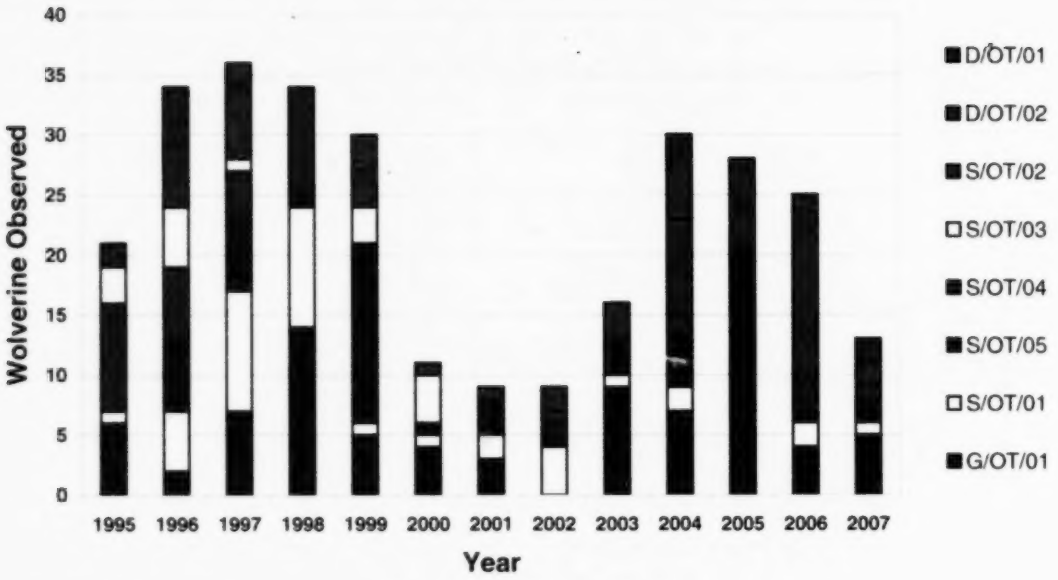

Figure 6. The number of wolverines observed by hunters from 1995-2007 and the outfitter zones where the observations occurred. Data are based upon voluntary hunter observation forms.

Black Bear (*Ursus americanus*)

Only 7 non-resident hunters purchased black bear tags in 2007. No black bears were harvested, as has been the case for the past 12 years. Black bears are relatively rarely seen in the Mackenzie Mountains and in most years are reported only from south of 63° 00 N. In 2007, 38 black bears (34 adults and 4 cubs) were observed based upon returned voluntary hunter observation forms. Bears were observed in outfitter zones D/OT/01 (6 adults and 2 cubs), D/OT/02 (27 adults and 2 cubs) and G/OT/01 (1 adult) (Table 19). As with the other post 2001 carnivore data, we assumed that all returned observation forms where blanks, zeroes, or dashes occurred in the boxes indicating the number of carnivores observed was a report of no carnivores being

observed. This assumption is likely invalid for previous years' data and likely inflates the 2002 through 2007 values relative to 1996-2001 values.

Table 19. Observations of black bear reported by non-resident hunters (including non-hunting guides) in the Mackenzie Mountains, 1995-2007.

	2007[1]		2006[1]		2005[1]		2004[1]		2003[1]		2002[1]	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total # Observed	4	34	2	27	4	21	1	23	3	34	3	17
% of Total Observed	11	89	7	93	16	84	4	96	8	92	15	85
No. Hunters Reporting	244	244	239	239	256	256	229	229	191	191	199	199
No. Hunters Saw at Least 1	2	17	1	14	3	18	1	19	2	21	2	14
Maximum # Observed	2	8	2	11	2	2	1	3	2	7	2	3

	2001		2000		1999		1998		1997		1996		1995[2]
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	All Bears
Total # Observed	0	7	2	15	4	7	0	15	2	3	1	10	11
% of Total Observed	0	100	12	88	36	64	0	100	40	60	9	99	nil
No. Hunters Reporting	127	130	88	93	87	89	121	124	96	96	6	14	44
No. Hunters Saw at Least 1	1	7	1	10	2	6	0	8	2	3	1	9	9
Maximum # Observed	0	1	2	3	2	2	0	3	1	1	1	2	2

[1] Change in reporting for 2002 may have resulted in artificially lower numbers of hunters reporting for 1995-2001, see text.

[2] All bears not separated out by cubs and adults.

Grizzly Bear (*Ursus arctos*)

The Mackenzie Mountains have been closed to non-residents for hunting grizzly bears since 1982 and resident hunters have been restricted to one bear per lifetime since the same year (Veitch, 1999). It is clear from the comments made by hunters on voluntary observation forms that, despite the lack of hunting opportunities, grizzly bears remain a subject of considerable interest for non-resident hunters and their guides in the Mackenzie Mountains (Appendices 3 and 4). Consistent with the past 9 years, hunters in 2007 reported the loss of meat, capes, food, and equipment to grizzly bears, and a perception that there were too many grizzly bears, and requested that a hunt should be considered. Even though moose calf numbers, based on hunter observations, are generally lower in the Mackenzie Mountains than those reported in the Mackenzie valley and predation by grizzly bears could be a potential cause (Ballard, 1992), there were no hunter comments indicating low moose or caribou calf numbers this year. A frequent comment of guided hunters is that bears have lost their fear of humans because of a lack of hunting and they are concerned that this was a human safety issue. Although there have been no documented injuries from grizzly bear attacks in the Mackenzie Mountains since the closure of the non-resident grizzly bear hunting season (Veitch, 1999), there were 3 incidents in 2007 in the southern Mackenzie Mountains when grizzlies claimed meat from a moose kill while guides were in the vicinity. In these instances the guide and hunter left the area without incident (Carl Lafferty, personal communication). Since 1993 there have been 54 nuisance grizzly bears killed, the majority in the Sahtu (n=33) and Gwich'in (n=14) Regions with

just seven in the Dehcho, but five of those seven kills occurred in the past two years (ENR Norman Wells and Fort Simpson, unpublished data).

While the mean number of adult grizzly bears observed by hunters has remained relatively stable from 1996-2007 (mean=308), the cub to adult ratio calculated from the hunter observations peaked in 2000 with cubs comprising 29% of all bears observed, declined to a low of 12% in 2003, increased to 25% in 2006 and declined to 19% in 2007 (Fig. 7; Table 20). Because cub grizzlies in the Mackenzie Mountains tend to stay with their mothers for 3 years (Miller *et al.*, 1982), reported observations of 'cubs' refers to cubs-of-the-year, yearlings, and 2-year-old bears. Miller *et al.* (1982) documented a low reproductive rate for female grizzly bears

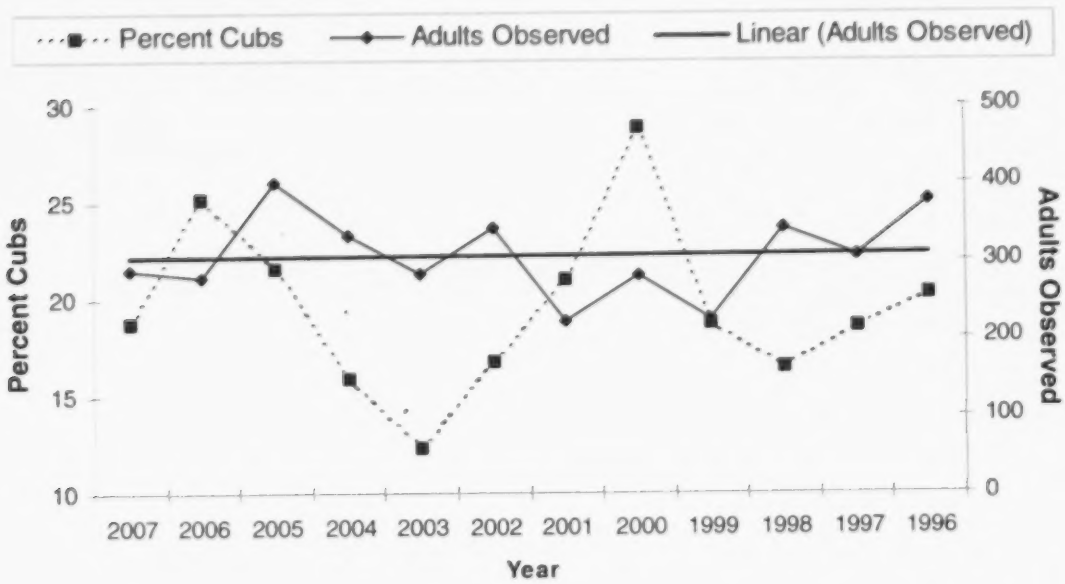

Figure 7. The percent of 'cubs' and the total number of adult grizzly bears observed by hunters from 1996-2007. Data are based upon voluntary hunter observation forms. The linear trend of total adult bears observed during the same time period is indicated.

in the Mackenzie Mountains, with no sows less than 8-years-old producing cubs, an average inter-litter interval of 3.8 years, and a mean litter size of 1.8. The percent 'cubs' determined from reported hunter observations during 1996-2007 indicates a periodicity of somewhat more than 4 years between low percentages of cubs (Fig. 7), which may or may not be similar to what was reported during 1973-1977 when there was non-resident hunting of grizzly bears. We estimated the mean litter size from hunter observation reports by analyzing just those observations of groups of grizzly bears where cubs were present with only 1 adult present. The estimated mean litter size in 2007 was 2.0, which falls within the range of 1.4-2.0 reported from 1996-2007. The 2.0 litter size reported for 2007 falls between the mean found by Miller *et al.* (1982) and the 2.2 reported for grizzly bears of Kodiak Island, Alaska (Troyer and Hensel, 1964). The demographic parameters of Mackenzie Mountain grizzly bears estimated during 1996-2007 are generally comparable to those reported during 1973-1977 by Miller *et al.* (1982).

Table 20. Observations of grizzly bear reported by non-resident hunters in the Mackenzie Mountains, 1995-2007; total number of bears observed, percent of cubs/adults, number of hunters reporting grizzly observations, number of hunters seeing at least one cub/adult, the mean and maximum number of cubs/adults observed. [1] All bears were not separated out by cubs and adults.

	2007		2006		2005		2004		2003		2002	
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult
Total # Observed	54	288	93	279	110	402	63	333	40	283	69	341
% of Total #	16	84	25	75	21	79	16	84	12	88	17	83
# Hunters reporting	28	127	50	122	49	150	34	131	19	120	34	128
# Hunters saw ≥1	17	56	32	70	10	65	15	57	9	53	11	48
Mean # Observed	1.9	2.3	1.9	2.3	2.0	2.3	1.9	2.5	2.1	2.4	2	2.7
Max. # Observed	5	15	5	12	10	16	4	15	12	7	8	20

	2001		2000		1999		1998		1997		1996		1995
	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	Cub	Adult	All Bears[1]
Total # Observed	59	222	113	281	52	225	68	343	70	306	96	377	389
% of Total #	21	79	29	71	19	81	17	83	19	81	20	80	nil
# Hunters reporting	136	171	108	131	98	117	139	177	110	170	49	132	138
# Hunters saw ≥1	28	104	51	97	28	81	31	105	32	129	46	129	123
Mean # Observed	0.4	1.3	1.1	2.1	0.5	1.9	0.5	1.9	0.6	1.8	2.0	2.9	2.8
Max. # Observed	5	10	8	12	4	12	6	16	12	17	5	15	16

ACKNOWLEDGEMENTS

We appreciate the co-operation from the outfitters operating in the Mackenzie Mountains in 2007, and thank them for the extra efforts they made in completing, signing, and sending us their harvest reports and meat distribution forms. We especially want to thank those outfitters who spent additional time compiling and sending information from Mile 222 so that this report could be completed in a timely fashion.

We thank Renewable Resources Officers and clerks with ENR in Norman Wells, Fort Simpson, and Fort Liard for collecting and organizing data from non-resident hunters in their respective offices. We also greatly appreciate the efforts, interest, and co-operation shown by our visiting hunters and the more than 80 guides that completed the forms, reported observations of animals seen, and did the various antler and horn measurements. We would particularly like to thank those hunters that took the time to write comments about their hunting experience.

We thank Mary Knox for ensuring that all data she received by the Sahtu ENR office was forwarded to the Fort Simpson ENR office, and Keith Hickling for providing the nuisance bear data. John Nagy provided unpublished data from his Dall's sheep work in the Richardson Mountains. We gratefully acknowledge the Boone and Crocket Club for providing us with access to their on-line trophy database and Safari Club International for providing us with caribou data from their on-line trophy database. We thank ITI for providing unpublished data from their 2006 exit survey questionnaire.

PERSONAL COMMUNICATIONS

Jan Adamczewski, Liard Regional Biologist, Fish and Wildlife Branch Yukon Environment, Watson Lake, YT, currently Wildlife Biologist, department of Environment and Naturakl Resources, Yellowknife, NT

Suzanne Carriere, Ecosystem Management Biologist, Department of Environment and Natural Resources, Yellowknife, NT

Ken Davidge, Renewable Resources Officer, Department of Environment and Natural Resources, Ft. Simpson, NT.

Kelly Hougen, President, Association of Mackenzie Mountain Outfitters, Whitehorse, YT.

Carl Lafferty, Renewable Resources Officer, Department of Environment and Natural Resources, Fort Simpson, NT.

Cam Lancaster, Nahanni Butte Outfitting, Lethbridge, AB.

Clay Lancaster, Nahanni Butte Outfitting, Hudson Hope, BC.

Jim Lancaster, Nahanni Butte Outfitting, Smithers, BC.

Mark O'Donoghue, Northern Tutchone Regional Biologist, Fish and Wildlife Branch, Yukon Environment, Mayo, YT.

Alasdair Veitch, Supervisor of Wildlife, Department Environment and Natural Resources, Norman Wells, NT.

LITERATURE CITED

Ballard, W.B. 1992. Bear predation on moose: A review of recent North American studies and their management implications. *Alces* (Supplement) 1: 1-15.

Bergerud. A.T. 1978. Caribou. pp. 83-102 *in* Schmidt, J.L. and Gilbert, D.L. (eds.) Big game of North America: ecology and management. Stackpole Books, Harrisburg, PA. 494 pp.

Bishop, R.H. and Raush, R.A. 1974. Moose population fluctuations in Alaska. 1950-1972. *Naturaliste Canadien* 101: 559-593.

Bubenik, A.B. 1972. North American moose management in light of European experiences. Proceedings of the North American Moose Conference Workshop 8: 279-295.

Bubenik, A.B. 1997. Evolution, taxonomy, and morphophysiology. pp. 77-123 *in* Franzmann, A.W. and Schwartz, C.C. (eds.) Ecology and management of the North American moose. Smithsonian Institution Press, Washington, DC. 733 pp.

Byers, C.R. and Bettas, G.A. 1999. Records of North American Big Game. 11th Edition. Boone and Crockett Club, Missoula, MT. 712 pp.

Creighton, T.B. 2006. Predicting mountain woodland caribou habitat in the Mackenzie and Selwyn Mountains through correlation of ARGOS collar locations and MODIS spectral reflectance. MSc Thesis, School of Geography, Birkbeck College, University of London. 112pp.

Crête, M., Taylor, R.J., and Jordan, P.J. 1981. Optimization of moose harvest in southwestern Quebec. *Journal of Wildlife Management* 45: 598-611.

Department of Environment and Natural Resources, 2005. Northwest Territories summary of hunting regulations 2005-2006. Department of Environment and Natural Resources, Yellowknife, NT. 26 pp.

EXCELeration corp. 2000. Benefits of outfitted hunting in the NWT Mackenzie Mountains. Final report prepared for the Association of Mackenzie Mountain Outfitters in co-operation with the town of Norman Wells and the Department of Resources, Wildlife & Economic Development. Calgary, AB. 45 pp.

Geist, V. 1971. Mountain sheep: a study in behaviour and evolution. University of Chicago Press, Chicago, IL. 383 pp.

Geist, V. 1993. Wild sheep country. NorthWord Press, Minocqua, WI. 173 pp.

Gullickson, D. and Manseau, M. 2000. South Nahanni woodland caribou herd seasonal range use and demography. Parks Canada Agency. 79pp.

Gunn, A., Farnell, R., Adamczewski, J., Dragon, J. And Labarge, L. 2002. Census for the South Nahanni mountain caribou herd, September 2001. Manuscript Rep. No. 147, Dept. of Resources, Wildlife & Economic Development, Yellowknife, NT. 31pp.

Jorgenson, J.T. 1992. Seasonal changes in lamb:ewe ratios. Northern Wild Sheep and Goat Council 8: 219-226.

Larter, N.C. 2004. Mountain goat survey Flat River area, Western Mackenzie Mountains, September 2004. Manuscript Rep. No. 157, Dept. of Resources, Wildlife & Economic Development, Ft. Simpson, NT. 16pp.

Larter, N.C. and Allaire, D.G. 2003. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary 2002. Manuscript Rep. No. 152, Dept. of Resources, Wildlife & Economic Development, Ft. Simpson, NT. 46pp.

Larter, N.C. and Allaire, D.G. 2004. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary 2003. Manuscript Rep. No. 154, Dept. of Resources, Wildlife & Economic Development, Ft. Simpson, NT. 46pp.

Larter, N.C. and Allaire, D.G. 2005a. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary 2004. Manuscript Rep. No. 165, Dept. of Environment and Natural Resources, Ft. Simpson, NT. 46pp.

Larter, N.C. and Allaire, D.G. 2005b. Sheep surveys of the Liard Range, Nahanni Range, and Ram Plateau in the Mackenzie Mountains, August 2003. Manuscript Rep. No. 166, Dept. Environment and Natural Resources, Ft. Simpson, NT. 16pp.

Larter, N.C. and Allaire, D.G. 2006. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary 2005. Manuscript Rep. No. 168, Dept. of Environment and Natural Resources, Ft. Simpson, NT. 61pp.

Larter, N.C. and Allaire, D.G. 2007. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary 2006. Manuscript Rep. No. 174, Dept. of Environment and Natural Resources, Ft. Simpson, NT. 55pp.

Latour, P. and MacLean, N. 1994. An analysis of data returned by outfitted hunters from the Mackenzie Mountains, NWT, 1979-1990. File Rep. No 110, Dept. of Renewable Resources, Norman Wells, NT. 41 pp.

MacLean, N. 1994*a*. Population size and composition of moose in the Tulita area, NWT, November 1993. Manuscript Rep. No. 78, Dept. of Renewable Resources, Yellowknife, NT. 18 pp.

MacLean, N. 1994*b*. Population size and composition of moose in the Fort Norman area, NWT, November 1993. Manuscript Rep. No. 80, Dept. of Renewable Resources, Yellowknife, NT. 17 pp.

Miller, S.J., Barichello, N. and Tait, D. 1982. The grizzly bears of the Mackenzie Mountains, Northwest Territories. N.W.T. Wildlife Service Compilation Rep. No. 3, Yellowknife, NT. 118 pp.

Minitab Inc. 1989. Minitab version 7.2 (computer program). State College, PA: Minitab Inc.

Nagy, J. and Carey, J. 1991. Dall sheep survey in the Richardson Mountains, 1991. Unpublished survey report manuscript, Dept. of Resources, Wildlife, and Economic Development, Inuvik, NT. 8 pp.

Nagy, J.A., Auriat, D. and Cooley, D. in prep. Richardson Mountains Dall's Sheep population survey, August 2003.

Nichols, L. and Bunnell, F. 1999. Natural history of thinhorn sheep. pp. 23-77 *in* Valdez, R. and Krausman, P.R. (eds.). Mountain sheep of North America. University of Arizona Press, Tucson, AZ. 353 pp.

Olsen, B. 2000. Fall distribution and population composition of woodland caribou in the central Mackenzie Mountains, October 2000. Manuscript Report No. 1 (draft), Sahtu Renewable Resources Board, Tulita, NT. 15 pp.

Olsen, B. 2001. Caribou studies in the Redstone River watershed: research proposal 2001. Unpublished research proposal submitted to Sahtu Renewable Resources Board, Tulita, NT. 5 pp.

Olsen, B., MacDonald, M., and Zimmer, A. 2001. Co-management of woodland caribou in the Sahtu Settlement Area: Workshop on Research, Traditional Knowledge, Conservation and Cumulative Impacts. Special Publication No. 1, Sahtu Renewable Resources Board, Tulita, NT. 22 pp.

Schwartz, C.C. 1997. Reproduction, natality, and growth. pp. 141-171 *in* Franzmann, A.W. and Schwartz, C.C. (eds.) Ecology and management of the North American moose. Smithsonian Institution Press, Washington, DC. 733 pp.

Schwartz, C.C., Regelin, W.L., and Franzmann, A.W. 1992. Male moose successfully breed as yearlings. *Journal of Mammalogy* 63: 334-335.

Simmons, N.M. 1968. Big game in the Mackenzie Mountains, Northwest Territories. Proceedings of the Federal-Provincial Wildlife Conference. 32: 35-42.

Solberg, E.J., Loison, A., Ringsby, T.H., Sæther, B.E., and Heim, M. 2002. Biased adult sex ratio can affect fecundity in primiparous moose *Alces alces*. *Wildlife Biology* 8: 117-128.

Troyer, W.A., and Hensel, R.J. 1964. Structure and distribution of a Kodiak bear population. *Journal of Wildlife Management* 28: 769-772.

Van Ballenberghe, V. 1983. The rate of increase in moose populations. *Alces* 25: 25-30.

Veitch, A.M. 1999. Status of grizzly bears in the Mackenzie Mountains, NWT. Unpublished report, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 28 pp.

Veitch, A.M. and Popko, R.A. 1996. 1995 Mackenzie Mountain non-resident hunter harvest summary. Manuscript Rep. No. 90, Dept. of Renewable Resources, Norman Wells, NT.
22 pp.

Veitch, A.M. and Popko, R.A. 1997. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1996. Manuscript Report No. 97, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 37 pp.

Veitch, A.M., Popko, R.A., and N. McDonald. 1996. Size, composition, and harvest of the Norman Wells area moose population, November 1995. Manuscript Rep. No. 93, Dept. of Renewable Resources, Norman Wells, NT. 32 pp.

Veitch, A.M. and Simmons, E.N. 1998. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1997. Manuscript Report No. 106, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 28 pp.

Veitch, A.M. and Simmons, N. 1999. Dall's sheep – Northwest Territories. pp. 54-58 *in* Toweill, D.E. and Geist, V. (eds.) Return of royalty: wild sheep of North America. Boone and Crockett Club and Foundation for North American Wild Sheep, Missoula, MT. 214 pp.

Veitch, A. and Simmons, E. 2000a. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1999. Manuscript Report No. 121, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 29 pp.

Veitch, A. and Simmons, E. 2000b. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 2000. Manuscript Report No. 121, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 40 pp.

Veitch, A.M., Simmons, E., Adamczewski, J., and Popko, R. 2000a. Status, harvest, and co-management of Dall's sheep in the Mackenzie Mountains, NWT. Northern Wild Sheep and Goat Council 11: 134-153.

Veitch, A., Simmons E., and Whiteman, N. 2000b. Mackenzie Mountain non-resident and non-resident alien hunter harvest summary, 1998. Manuscript Report No 120, Dept. of Resources, Wildlife & Economic Development, Norman Wells, NT. 31 pp.

Veitch, A.,Popko, R. and Whiteman, N. 2000c. Classification of woodland caribou in the central Mackenzie Mountains, Northwest Territories, August 1999. Dept. of

Resources, Wildlife & Economic Development Manuscript Rep. No. 122, Norman Wells, NT. 13 pp.

Veitch, A, Simmons, E., Promislow, M., Tate, D., Swallow, M, and Popko, R. 2002. The status of mountain goats in Canada's Northwest Territories. Northern Wild Sheep and Goat Council 13: 49-62.

Weaver, J.L. 2006. Big animals and small parks: implications of wildlife distribution and movements for expansion of Nahanni National Park Reserve. Wildlife Conservation Society Canada, Conservation Report No. 1. Toronto, ON. 100pp.

Yukon Renewable Resources. 1996. Sheep management guidelines. Dept. of Renewable Resources, Yukon Territorial Government, Whitehorse, YT. 10 pp.

APPENDIX A.

Outfitters Licenced To Provide Services To Non-resident Hunters In The Mackenzie Mountains, NT – 2007.

D/OT/01 – SOUTH NAHANNI OUTFITTERS LTD.
Werner Aschbacher and Sunny Peterson
PO Box 31119
Whitehorse, YT Y1A 5P7
Ph: (867)-399-3194
Fx: (867)-399-3194
e-mail: info@huntnahanni.com
website: www.huntnahanni.com

D/OT/02 – NAHANNI BUTTE OUTFITTERS
Cam, Clay and Jim Lancaster
PO Box 653
Hudson Hope, BC VOC 1VO
Ph: (403)-380-2789
Fx: (403)-380-6126
e-mail: c2c@xplornet.com
website: www.lancasterfamilyhunting.com

G/OT/01 – ARCTIC RED RIVER OUTFITTERS
Kelly and Heather Hougen
3 Chesnut Place
Whitehorse, YT Y1A 4X4
Ph: (867)-633-4934
Fx: (867)-633-4934
e-mail: info@arcticred-nwt.com
website: www.arcticred-nwt.com

S/OT/01 – GANA RIVER OUTFITTERS
Harold Grinde
P.O. Box 528
Rimbey, AB T0C 2J0
Ph: (403)-783-3499
e-mail: ganariver@telus.net
website: www.ganariver.com

S/OT/02-MACKENZIE MOUNTAIN OUTFITTERS
Stan and Helen Stevens
P.O. Box 175
Dawson Creek, BC V1G 4G3
Ph: (250)-786-5118
Fx: (250)-786-5118
e-mail: stevens.mmo@pris.bc.ca
website: www.mmo-stanstevens.com

S/OT/03 – RAM HEAD OUTFITTERS
Stan and Debra Simpson
P.O. Box 89
Warburg, AB T0C 2T0
Ph: (780)-848-7578
Fx: (780)-848-7550
e-mail: ramheadoutfitters@hotmail.com
website: www.ramheadoutfitters.com

S/OT/04 - NWT OUTFITTERS
Eric Mikkelson
PO Box 106
Lazo, BC V9N 8Z8
Ph: (888)-293-2299
Fx: (250)-897-0054
e-mail: nwtoutfitters@shaw.ca
website: www.nwtoutfitters.com

S/OT/05 - REDSTONE TROPHY HUNTS
Dave Dutchik
P.O. Box 18
Pink Mountain, BC VOC 2BO
Ph: (250)-772-5992
Fx: (250)-261-9962
e-mail: redstone@netkaster.ca
website: www.redstonehunts.com

APPENDIX B.

Summary Of Fees, Bag Limits, and Seasons For Big Game Species Available To Non-residents In The Mackenzie Mountains, NT - 2007. [Note: all prices are in Canadian funds.]

Species	Status	Tag Fee	Trophy Fee	Bag Limit	Season
Black Bear	Non-resident	$20.00	$100.00	1 adult bear not accompanied by a cub	15 Aug - 31 Oct 15 Aug – 30 June
	Non-resident alien	$50.00	$100.00		
Woodland Caribou	Non-resident	$20.00	$200.00	1	25 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Mountain Goat	Non-resident	$20.00	$200.00	1	15 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Moose	Non-resident	$20.00	$200.00	1	1 Sep - 31 Oct
	Non-resident alien	$50.00	$200.00		
Dall's Sheep	Non-resident	$20.00	$200.00	1 adult male with min. ¾ curl	15 Jul - 31 Oct
	Non-resident alien	$50.00	$200.00		
Wolf	Non-resident	$20.00	$100.00	1	15 Aug - 31 May 25 Jul - 10 Oct
	Non-resident alien	$50.00	$100.00		
Wolverine	Non-resident	$20.00	$100.00	1	15 Aug - 31 Oct 25 July - 31 Oct
	Non-resident alien	$50.00	$100.00		

Source: Department of Environment and Natural Resources. 2007. Northwest Territories Summary of Hunting Regulations. Department of Environment and Natural Resources, Yellowknife, NT. 26 pp.

APPENDIX C.

Comments Provided From Non-resident Hunters In The Mackenzie Mountains, NT On Voluntary Hunter Wildlife Observation Report Forms, 2007.

We have not printed actual names of outfitters or their guides (XXX).

Will return for repeat! Great experience.
Great experience. Wonderful country.
Could not be better.
Excellent outfitter and guide.
The experience was one of my best yet!!
The area is not over-hunted. The hunting game management of XXX is excellent.
Great hunt - Great land - Great game - Great people
It is definitely good to have a strict wildlife management so that future generations can enjoy this magnificent experience of hunting in this environment as well.
Excellent hunting, too many grizzly's! Could not retrieve the goat, got stuck in a cliff which was not accessible.
Open Grizzly bear season (safety)
The problem about the grizzly bears!!!
Excellent hunt, beautiful area.
Beautiful area with lots of game.
Very good and professional run operation.
Excellent outfitter. XXX Outfitters.
Moose got hit but could not be found, after several days of searching. Great outfitter.
Excellent outfitter + area.
Very good organization. Grizzly tracks all over - Dangerous - need permit.
A grizzly bear season should be considered. We had an incident with a bear over who owned some moose meat.
Looks like your doing a good job, everything was perfect, lot of animals.
Very nice country, great outfitter, very nice people. Don't like the future plans for the park at all.
Very challenging area to hunt, especially in bad weather, but very rewarding.
Excellent guide and outfitter as always. Top notch outfit lots of game.
Great hunt! Do it again in a flash!
Weather questionable! Great hunt with whole crew! #1.
Lots of game, excellent country.
Highly recommend hunting Dall's sheep with XXX! Very happy with the XXX hospitality and family.
We are very happy with the XXX hospitality and we return one other time in the NT.
Great time, XXX provided great guides and accommodations. Successful hunt. We plan on returning again. Thanks.
Hunt was awesome! XXX runs a first class outfitting business. My guide, XXX, was hard working, ethical, and a great person. A true dream come true.
Awesome hunt. We saw good rams everyday rough country, but rewarding. Guide worked hard to get us to the sheep.
This was a hunt of a lifetime! I was able to achieve something I had been waiting for a long time, my first sheep! The time I spent here is something I will never forget. Thanks XXX and XXX, + thanks to everyone! Hope to see you guys again - soon.
Very enjoyable hunt, with memories to last, outfitter and guide were outstanding.
XXX is a great outfitter. Their territory in the NWT is some of the best in the world. Their conservations efforts are among some of the best I have seen.
XXX runs an excellent operation. A real pleasure to hunt with them.
Shot wrong ram but killed 11.5 year old billy.
Poor weather! Lots of game when I could see. I'll be back next year for better weather.
Great hunt. Great experience. Very professional company. Very accommodating. Very good food, guides, aircraft etc. It would be a shame to see this hunting area made into a national park as no one will use it.

The area is nice, wildlife is abundant and the outfitters and guides were excellent. It is a first rate camp and the best hunting trip I have been on.
I' m coming back, that says it all.
Great Outfit! Great guys!
My hunt was excellent, the outfitter was very accommodating and knowledgeable. I saw lots of wildlife and beautiful scenery I will be back again.
Extremely memorable trip of a lifetime. Excellent everything, guide to cook
Beautiful area, great outfitter who is respectful of the land as well as the wildlife - a perfect combination of utilization and stewardship - very professional and a credit to the profession as well as Canada.
I would love to hunt for a Mackenzie Mountain grizzly bear.
Beautiful area - just the way God created it - hope it stays that way. People are great.
Quit hunt early. Nice scenery - lots of mosquitoes, weather OK - people are friendly.
Bow hunter, wounded a ram and could not recover it.
Wounded with bow did not recover.
Excellent area/ outfitter. All animals looked in great shape.
All animals looked in great shape.
Unbelievable! All in good condition very healthy lamb crop 40%.
Lots of game, excellent time in mountains. Consider opening wolf season July 15. Great lamb count. About 90 % of mature ewes had lambs. Harvested ram had few ticks.
Nice to have a grizzly season. All animals looked in great shape.
Lots of grizzly sign. Population of grizzlies would seem to support a hunt? Good lamb count. 90%
Outstanding outfitter - XXX very professional.
A lot of grizzly. Wished we could hunt them! XXX and crew do an excellent job.
Wonderful experience!
Seen lots of rams and ewes + lambs. Everything looks healthy lots of lambs.
Excellent lamb count. Rams fat and in good shape.
Great area! Grizzly tags would be a nice addition to the area. All game in great shape.
Booked again 2011.
Lots of grizzly seen. It would be excellent to have a hunting season for grizzly. All game was in excellent condition.
Sheep all looked healthy lamb count very high too many sheep to count.
This was XXX's 14th hunt with us!
Surprise at the number + quality of sheep seen. Saw more grizzly bear sign than I expected. Did not see this much in Alaska. Excellent lamb crop. All other animals looked in good shape.
Lots of sheep all looked very healthy good lamb crop lots of feed great hunt lots of caribou.
XXX was 1st class.
All game in good condition.
2 lambs with black tails, lots of healthy lambs.
Lots of game, bad weather socked in most of hunt, good lamb count on sheep.
Everything looks healthy lots of feed + water good hunt.
Another great hunt. I enjoyed the whole experience again. I can't thank XXX & XXX & their crew enough for allowing any hunter who enters their area an opportunity of a lifetime to harvest some wonderful trophies. They certainly know how to manage it right.
Crew and outfit are outstanding! Lots of moose along Arctic Red River.
All game was in excellent shape.
All game was in excellent shape.
Excellent game seen. Hunter went home early due to bad knee.
All game looked in excellent condition.
It was a very good and successful trip.
XXX provides an extremely well run operation.
Very nice guides, great time.
Beautiful country + overall great experience. First Class operation - no doubt.
This ram was the first we have ever seen that had ticks! Probably about 30 were seen - the hunter is from Mississippi + knows what a tick is! Positive ID of ticks on this ram - He seemed healthy otherwise. Most beautiful place on earth! XXX are professional conservationists and stewards of the land.

Absolutely Beautiful country. Rich with game. Excellent outfitter & staff. Very great experience.
XXX was a real cluster with Geologists staying at the Palmer Lake camp? Everywhere we hunted on horseback and foot, every creek, drainage was left evidence of orange flagging material tied to trees & willows. Very disappointing to see and it certainly took/ takes away from a remote hunt & holiday getaway. (not only pollution, but game harassment) Were they really re-mapping?
Way too many grizzly bears, I saw some of the same bears 3 to 4 times, charged by one once.
Great Hunting not over hunted still good opportunity to hunt & see animals, great place.
Beautiful & excellent outfitters.
XXX are the best. I came in a wheel chair and you can't believe the way they took care of me.
XXX took excellent care of us. Great hunt hope to return for moose.
XXX is 1st class. Very good hunt and a lot of good memories.
I have already or will book a moose hunt for Sept 2009 with XXX. Any information on moose in Mackenzie Mountains would be appreciated in the future.
Saw lots of animals, shot my sheep on the second day of hunting, and was in camp most of the time until we moved to a different area to shoot my caribou.
Most of the sightings were seen while only hunting for 5 days.
Both the ram and caribou had been injured - probably by wolves. The sheep was inedible - probably fevered and sour. The caribou had fresh bruising wounds on hinds quarters and back. Some meat unusable.
Had a great time and what a beautiful place. Very pristine and mostly untarnished by commercial civilization.
Need to allow non-residents to harvest grizzly bears.
XXX - Top Notch professionals.
Thanks for a great time, see you again.
My sheep had lung disease.
The sheep looked in good shape, looks like a good lamb crop. I observed 4 adult grizzly bears and also observed a lot of bear sign around our camps.
Very beautiful country. Fewer large rams than I expected. The XXX run a first class operation in every way.
Excellent hunting - Super outfitter, first class.
The vastness of this area is awesome and it makes one feel so small.
It was an experience of a lifetime! Beautiful scenery - cordial hosts - great guides - an adventure beyond my expectations. Especially great hunting with my husband, an anniversary treat!
XXX is a very well run 1st class operation. I greatly enjoyed everything about the territory and its beautiful mountains, water and wildlife.
What a resource!
As usual beautiful country, plentiful game, and professional outfitting - From number of bears seen and amount of sign, I feel something should be done to reduce their population - like a season.
Took 37.25 full curl ram @ 26 yards with my recurve bow and handmade cedar arrow named Dall's sheep!! No complaints!
XXX and their staff and guides are very organized and do an excellent job in harvesting the older rams. My experience in the Mackenzie Mountains was absolutely awesome!
We had a wonderful hunt!
Grizzly got the rest
Hunter got sick went home
Good population of mature animals - Beautiful country-lots of sign-scat, tracks etc. for wolf and bear.
Wolf sign was everywhere but did not see any?
Never know from year to year where I will end up. Had a great time. Would be nice if it were a little easier to get our trophies out of NWT.
Wonderful area for hunting.
Great country will be back soon. Saw lots of nice country. All animals appear to be healthy and doing well.
Not what I expected. Not many sheep to choose from. Didn't see as much game as anticipated.
Enjoyed the adventure, experience, had a wonderful time. Looking forward to the next trip-XXX was a great comic, guide and good company.
Great overall experience - beautiful country - great guides and camp. Incredible tough country - untouched - saw 3 beautiful legal rams on first day of hunt and several lambs and ewes. Harvested an old mature ram on the second day of the hunt. The mountains were beautiful and stereotypical sheep country - steep slopes and loose shale.
Excellent hunt, absolutely the best guides. Hospitality, the best. First class operation. Beautiful country.

Great hunt, lots of animals, incredible scenery. Lots of game. All appeared to be healthy and in great shape.
Great hunt, wonderful people and amazing scenery. The sheep population appears to be in excellent condition; all rams harvested were mature (over 10yrs). Caribou #'s seemed very healthy and the amount of wildlife was exceptional.
Great hunt in some of the most beautiful country I've ever seen.
Lots of game.
Lots of game (excellent rams). Lots of adult game of good quality.
Lots of game, Great country, well managed hunting camp and guides. Excellent big game hunting, great habitat and the best outfitter I've ever had, hard working, honest and trying to help each hunter achieve their goals.
You read all your life about people who have experienced this area, but I never expected to see it for myself! Keep it like this for future generation! All of the animal's were very healthy and look very adapted to their life here.
Very enjoyable hunt.
Tres bien!
Lots of game and beautiful scenery!
Great hunt.
Lots of game, beautiful country.
Beautiful area to hunt what an experience to be here. Good guides they know the area. Gee the helicopter pilot is very good! Wildlife looked very healthy, a lot of it, no sick wildlife was seen on my hunt.
Great hunting, big country. Great animals, healthy animals.
Caribou moved into area in larger numbers after September 5th and in excellent condition; caribou harvested bull with 1" thick subcutaneous layer of fat; full curl ram harvested was also well fatten. Grizzly bears seem abundant.
XXX does an excellent job of hunter safety. Experienced guides added to the adventure. The weather was the weather but in the end, we were successful. Lots of caribou, in excess of 100 plus cows and calves. Lots of ewes and lambs. Played hide and seek with the rams. In the end we were successful in taking a ram.
Saw hundreds of caribou all appeared healthy no large bulls, 2 young bears, 3 moose and 5 sheep all appeared healthy.
Just another animal hunt.
Had a wonderful time saw lots of game, will return again. We saw many animals everyday. They seem to be in great shape, bulls, cow and calves.
Saw a lot of game.
Very healthy animals, great experience. Everyone should experience the Mackenzie Mountains. XXX is an awesome person to spend an adventure hunting moose. XXX is an awesome help to aid in the experience. Very healthy animals, very beautiful area, big game in Mackenzie Mountains are a great adventure.
A great hunt & experience. XXX went one + above to help me get my moose. A tremendous trip. Thanks XXX.
Excellent base camp and meals. Saw a lot of wildlife. Great guides, really happy with my moose.
Had a good time. Lot of game + good quality, love the place.
Beautiful area - excellent guide - XXX great outfitter- XXX. All animals - healthy, grizzly - silverback – very large. Caribou bull - young, large bull moose massive - 49", rams seen at a distance.
The game I saw looked healthy, there was an abundance of game.
1 great bull caribou.
XXX provided a great hunting experience. The numbers of rams and quality seemed to be satisfactory. This was my first sheep hunt.
Beautiful country
Enjoyed trip, beautiful scenery.
Had a great experience.
Awesome country. Fabulous amount of game!
Love it here can't wait till next summer.
Seen lots of game, and too many grizzly bears. I want a mountain named me after 29 years.

APPENDIX D

A Summary of the 2007 Voluntary Hunter Comments Broken Down Into Specific Topics.

No. of hunters reporting	No. of hunters mentioning good quality hunts	No. of hunters mentioning abundance of animals	No. of hunters mentioning grizzlies	No. of hunters mentioning wolves	No. of hunters mentioning Park expansion	No. of hunters mentioning bad weather
155	79	34	22	4	2	4

APPENDIX E.

Number, Age, and Horn Length Measurements of Dall's Sheep Rams Harvested By Non-resident Hunters In the Mackenzie Mountains, 1967-2007.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean (cm)	Sample Size
1967-1968	223	8.4	Unknown	86.4	168
1969	110	-	-	-	-
1970	94	-	-	-	-
1971	88	-	-	-	-
1972	110	8.5	96	86.2	90
1973	89	8.9	86	84.4	88
1974	93	9.2	85	88.6	91
1975	129	7.6	67	84.6	127
1976	144	7.8	46	88.0	144
1977	132	5.7	69	86.8	132
1978	187	8.5	115	88.9	165
1979	200	8.7	108	90.7	154
1980	180	-	-	89.9	127
1981	187	8.1	101	93.7	157
1982	126	8.7	98	89.7	124
1983	100	9.0	80	90.9	94
1984	102	8.4	98	91.2	99
1985	123	8.1	115	89.7	112
1986	154	8.8	132	88.4	153
1987	148	8.9	148	89.4	148
1988	177	9.8	166	91.7	161
1989	207	9.9	199	90.4	203
1990	219	9.8	200	90.2	218
1991	170	9.7	161	89.1	170
1992	203	9.7	199	88.0	202

APPENDIX E (CONT.) -

Number, Age, and Horn Length Measurements of Dall's Sheep Rams Harvested by Non-resident Hunters in the Mackenzie Mountains, 1967-2007. Number Harvested Includes [1]10, [2]2, [3]10 and [4]6 Harvested By Resident Hunters.

Year	Number of Sheep Harvested	Age (Years)		Length of Right Horn	
		Mean	Sample Size	Mean	Sample Size
1993	191	9.7	181	87.6	190
1994	199	9.5	191	89.8	196
1995	190	9.7	189	89.3	189
1996	201	9.5	200	88.7	201
1997	210	10.0	206	89.9	203
1998	215	10.0	207	90.0	209
1999	204	10.2	183	88.8	184
2000	189	10.0	189	89.5	189
2001	199	10.0	188	87.7	189
2002	173	9.9	166	89.2	166
2003	213	9.7	210	89.8	212
2004	201[1]	10.0	199	89.3	200
2005	203[2]	10.2	196	89.4	199
2006	208[3]	10.4	206	88.4	207
2007	216[4]	10.8	216	88.3	216

APPENDIX F.

Summary Of Age and Sex Ratios Calculated From Non-resident Hunter Observation Reports in the Mackenzie Mountains, 1995-2007.

Year	Dall's Sheep		Mountain Caribou		Moose	
	Lambs: 100 Ewes	Rams: 100 Ewes	Calves: 100 Cows	Bulls: 100 Cows	Calves: 100 Cows	Bulls: 100 Cows
1995	67	82	36	34	30	95
1996	44	82	45	40	26	76
1997	57	55	36	21	30	107
1998	60	84	36	34	30	95
1999	58	90	43	25	20	100
2000	47	90	41	39	26	89
2001	59	89	56	61	28	120
2002	58	89	59	31	29	96
2003	50	83	39	36	25	129
2004	53	93	42	38	30	101
2005	51	98	42	42	33	110
2006	53	96	43	37	33	137
2007	64	83	52	37	36	101
Mean 1995-2007	55	86	44	37	29	104

APPENDIX G.

Outfitted Non-resident Hunter Harvests In the Mackenzie Mountains, 1991-2007.

Number harvested includes [1]10, [2]2, [3]10 and [4]6 harvested by resident hunters.

Year	Number of Licences Sold	Number of Animals Harvested					
		Dall's Sheep	Mountain Caribou	Moose	Mountain Goat	Wolf	Wolverine
1991	354	170	179	40	6	14	3
1992	364	203	142	32	4	7	0
1993	382	191	191	56	9	7	3
1994	356	199	164	46	5	15	2
1995	344	190	180	49	6	14	1
1996	387	201	175	46	4	11	4
1997	352	210	168	44	2	17	1
1998	345	215	160	52	5	9	0
1999	321	204	117	36	1	11	3
2000	332	189	127	44	1	14	0
2001	339	199	132	47	2	15	2
2002	329	173	168	42	5	11	1
2003	347	213	143	48	6	12	0
2004	337	201[1]	135	55	6	18	0
2005	394	203[2]	160	74	18	19	1
2006	407	208[3]	188	72	12	23	1
2007	405	216[4]	165	74	21	12	0
Mean 1991-2007	359	199	158	50	7	13	1